Department of Design and Construction

PROJECT ID: CRO-AGS

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

30-30 THOMSON AVENUE
LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000
WEBSITE www.nyc.gov/buildnyc

LAW

VOLUME 1 OF 3

BID BOOKLET

FOR FURNISHING ALL LABOR AND MATERIALS
NECESSARY AND REQUIRED FOR:

Croton New Above Ground Structure and Landscaping Rebid

LOCATION: 3651 Jerome Avenue
BOROUGH: Bronx, NY 10467
CITY OF NEW YORK

CONTRACT NO. 1 GENERAL CONSTRUCTION WORK

NYC Department of Environmental Protection

Grimshaw Architects

Date: October 26, 2017

T 8-028

Department of Design and Construction

Lorraine Grillo
Commissioner

August 03, 2018

CERTIFIED MAIL - RETURN RECEIPT REQUEST
C & L CONTRACTING CORP
1981 MARCUS AVENUE, STE#E106
LAKE SUCCESS, NY 11042

RE: FMS ID: CRO-AGS
E-PIN: 85018B0040001
DDC PIN: 8502018CT0001C
CROTON NEW ABOVE GROUND
STRUCTURE AND LANDSCAPING
REBID-BRONX
NOTICE OF AWARD

Dear Contractor:

You are hereby awarded the above referenced contract based upon your bid in the amount of $83,824,574.00 submitted at the bid opening on March 01, 2018. Within ten (10) days of your receipt of this notice of award, you are required to take the actions set forth in Paragraphs (1) through (3) below. For your convenience, attached please find a copy of Schedule A of the General Conditions to the Contract, which sets forth the types and amounts of insurance coverage required for this contract.

(1) Execute two copies of the Agreement in the Contracts Unit, 30-30 Thomson Avenue, 1st Floor, Long Island City, New York (IDCNY Building). A Commissioner of Deeds will be available to witness and notarize your signature. The Agreement must be signed by an officer of the corporation or a partner of the firm.

(2) Submit to the Contracts Unit two properly executed performance and payment bonds. If required for this contract, copies of performance and payment bonds are attached.

(3) Submit to the Contracts Unit the following insurance documentation: (a) original certificate of insurance for general liability in the amount required by Schedule A, and (b) original certificates of insurance or other proof of coverage for workers' compensation and disability benefits, as required by New York State Law. The insurance documentation specified in this paragraph is required for registration of the contract with the Comptroller's Office.

On or before the contract commencement date, you are required to submit all other certificates of insurance and/or policies in the types and amounts required by Schedule A. Such certificates of Insurance and/or policies must be submitted to the Agency Chief Contracting Office, Attention: Risk Manager, Fourth Floor at the above indicated department address.

Your attention is directed to the section of the Information for Bidders entitled "Failure to Execute Contract". As indicated in this section, in the event you fail to execute the contract and furnish the required bonds within the (10) days of your receipt of this notice of award, your bid security will be retained by the City and you will be liable for the difference between your bid price and the price for which the contract is subsequently awarded, less the amount of the bid security retained.

Sincerely,

Michael Shipman
Director of Contracts

BID BOOKLET
PART A

THIS PAGE INTENTIONALLY LEFT BLANK

PROJECT ID: CRO-AGS

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

BID BOOKLET

TABLE OF CONTENTS

PART A **page**

1. Special Notice to Bidders..... 2
2. M/WBE Program: M/WBE Utilization Plan..... 5
3. Bid Form..... 10
4. Affirmation..... 15
5. Bidder's Identification of Subcontractors..... 16
6. Bid Bond..... 18
7. Contractor's Bid Breakdown 21
8. Attachment 1 - Bid Information..... 22

PART B

9. Safety Questionnaire..... 23
10. Pre-Award Process 26
11. Project Reference Form..... 28
12. Contract Certificate..... 31
13. Confirmation of Vendex Compliance..... 32
14. Iran Divestment Act Compliance Report..... 33
15. Construction Employment Report..... 35

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

SPECIAL NOTICE TO BIDDERS

BID SUBMISSION REQUIREMENTS

THE BID SHALL CONSIST OF TWO (2) SEPARATE, SEALED ENVELOPES. THE DOCUMENTS THAT MUST BE COMPLETED AND INCLUDED IN EACH SEPARATE ENVELOPE ARE LISTED BELOW.

BID ENVELOPE #1: Bid Envelope #1 shall contain the following items:

- Bid Form, including Affirmation
- Bid Security (if required, see page 22)
- Schedule B: M/WBE Utilization Plan (if participation goals have been established)

BID ENVELOPE #2: Bid Envelope #2 shall contain **ONLY** the following item:

- Bidder's Identification of Subcontractors (see pages 16 & 17)

FAILURE TO SUBMIT THE FOUR ITEMS LISTED ABOVE WILL RESULT IN THE DISQUALIFICATION OF THE BID

BID ENVELOPE #1: In addition to the items listed above, Bid Envelope #1 shall also contain the following items: DO NOT Include the items listed below in Bid Envelope #2.

- Bid Breakdown (if required, see page 21)
- Safety Questionnaire
- Construction Employment Report (if bid is $1,000,000 or more)
- Contract Certificate (if bid is less than $1,000,000)
- Confirmation of Vendex Compliance
- Bidder's Certification of Compliance with Iran Divestment Act
- Special Experience Requirements Qualification Form (if required, see pages 3, 4)
- Any Addenda issued prior to the receipt of bids

FAILURE TO SUBMIT THE EIGHT ITEMS LISTED ABOVE MAY RESULT IN THE DISQUALIFICATION OF THE BID.

NOTES: (1) All of the above referred to blank forms to be completed and submitted with the bid are included in the BID BOOKLET.

(2) If the bidder has any questions or requires additional information, please contact the Department of Design and Construction by phone (718-391-2601) or by fax (718-391-2627).

(3) VENDEX QUESTIONNAIRES: Vendex Questionnaires, as well as detailed instructions, may be obtained at www.nyc.gov/vendex. The bidder may also obtain Vendex forms and instructions by contacting the Agency Chief Contracting Officer or the contact person for this contract.

(4) SPECIAL EXPERIENCE REQUIREMENTS: The Bidder is advised that Special Experience Requirements may apply to this contract. Such requirements are set forth on pages 3 and 4 of this Bid Booklet.

(5) SPECIAL EXPERIENCE REQUIREMENTS FOR ASBESTOS: The Bidder is advised that this contract contains strict requirements regarding the prior experience and licensing of the subcontractor who will perform any required asbestos abatement work. These special experience requirements are set forth in the section of the specifications which describes any required asbestos abatement work.

Special Notice to Bidders – Proprietary Items

A. General: A proprietary item required for the Project is specified below. The contractor is required to provide and install such proprietary item. The Contractor must provide the specified item from the designated manufacturer. Substitutions are not permissible and will not be approved. More detailed information regarding the item is set forth in the Specifications. Such information includes item description, as well as requirements for installation and related materials.

B. Payment: For the required proprietary item, an allowance amount is indicated. The allowance provides a stipulated amount to reimburse the Contractor for the purchase of the proprietary item from the designated manufacturer. Payment from the allowance shall be limited to the purchase price of the specified proprietary item and shall exclude any costs above and beyond the purchase price. Payment from the allowance shall not include any of the following costs with respect to the specified proprietary item: (1) any mark-up for the Contractor's overhead and profit, (2) any costs for transportation, including delivery, shipping or special handling costs, (3) any costs for installation, and (4) any costs for related materials. Payment for the specified proprietary item shall be based on the invoice actually provided by the manufacturer.

C. Bid Form: A total allowance amount for the purchase of all required proprietary items is set forth on the Bid Form. In preparing the lump sum portion of its bid, the Contractor shall:

(1) Exclude from its bid any costs for the purchase of the proprietary items, and

(2) Include in its bid any costs above and beyond the purchase price, including without limitation, costs for transportation, delivery, installation, related materials and overhead.

D. Required Proprietary Item(s):

CONTRACT NO. 1:

1.	Proprietary Item:	Sheerfill II-HT Architectural Membrane
	Specification Section:	133123 Tensioned Fabric Structures
	Manufacturer:	Saints-Gobain
	Allowance Amount:	Not to Exceed $348,910
4.	Proprietary Item:	Flagpoles
	Specification Section:	107500
	Manufacturer:	Pole-Tech Inc.
	Allowance Amount:	Not to Exceed $4,725

3.	Proprietary Item:	Mt Airy 3/32"-3-16" Aggregate Overlay Over Asphalt Paving
	Specification Section:	321217 Aggregate Overlay over Asphalt
	Manufacturer:	The North Carolina Granite Corp
	Allowance Amount:	Not to Exceed $580
2.	Proprietary Item:	Mt Airy 3/8" Exposed Aggregate in Concrete Paving
	Specification Section:	321313 Concrete Paving
	Manufacturer:	The North Carolina Granite Corp
	Allowance Amount:	Not to Exceed $20,967
5.	Proprietary Item:	Irrigation Pump Station, Controls, Line Decoders, and Weather Station
	Specification Section:	328000 Irrigation System & 328001 Irrigation Pump System
	Manufacturer:	Toro Lynx
	Allowance Amount:	Not to Exceed $115,080

SPECIAL EXPERIENCE REQUIREMENTS

Special Experience Requirements apply as indicated below.

Bidder(s):	**General Construction**	**___X___ YES**	**_____ NO**
Specific Areas of Work:	**General Construction**	**___X___ YES**	**_____ NO**
Manufacturer(s):	**General Construction**	**___X___ YES**	**_____ NO**

(A) **SPECIAL EXPERIENCE REQUIREMENTS FOR THE BIDDER IF APPLICABLE:** The special experience requirements set forth below apply to the bidder only if indicated above. Compliance with such special experience requirements will be determined solely by the City prior to an award of contract. Failure to comply with the special experience requirements will result in the rejection of the bid as non-responsive.

- The bidder must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

(B) **QUALIFICATION FORM**: For each project submitted to demonstrate compliance with the special experience requirements, the bidder(s) indicated above must complete the Qualification Form included in the Bid Booklet. The City will only evaluate a project if the following criteria are met: (1) the project is described on the Qualification Form, and (2) all information on the Qualification Form is provided. The City will not evaluate any project which does not comply with the criteria set forth herein, including any project which is referred to only on the resume of an individual.

(C) **CONDITIONS**: The City may, in determining compliance with the special experience requirements set forth above, consider prior projects completed by principal(s) or other employees of the bidder while affiliated with another entity, subject to the conditions set forth below.

- Any principal or other employee on whose prior experience the bidder is relying to demonstrate compliance with this special experience requirement must have held the following: (a) a significant management role in the prior entity with which he/she was affiliated, and (b) a significant management role in the entity submitting the bid for a period of six months or from the inception of the bidding entity. If the bidder is relying on the prior experience of a principal or employee, it must submit documentation confirming the position held by such principal or employee in the prior entity, as well as in the bidding entity.

- The bidder may not rely on the experience of its principals or other employees to demonstrate compliance with any other requirements, including without limitation, financial requirements or requirements for a specified minimum amount of annual gross revenues.

(D) **JOINT VENTURES**: In the event the bidder is a joint venture, at least one firm in the joint venture must meet the above described experience requirements.

(E) **EXPERIENCE REQUIREMENTS FOR SPECIFIC AREAS OF WORK**: The special experience requirements set forth below apply to the contractor or subcontractor that will perform specific areas of work. Compliance with such experience requirements will be evaluated after an award of contract. Within two (2) weeks of such award, the contractor will be required to submit the qualifications of the contractor or subcontractor that will perform these specific areas of work. If the bidder intends to perform these specific areas of work with its own forces, it must demonstrate compliance with the special experience requirements. If the bidder intends to subcontract these specific areas of work, its proposed subcontractor(s) must demonstrate compliance with the special experience requirements. Once approved, no substitution will be permitted, unless the qualifications of the proposed replacement have been approved in writing in advance by the City. The bidder is advised to carefully review these special experience requirements prior to submitting its bid, as such experience requirements will be strictly enforced.

(1) Special experience requirements apply to the contractor or subcontractor that will perform specific areas of work specified in the section(s) set forth below.

General Construction

- Section 033519: Polished Concrete Floor Finishing
- Section 034500: Architectural Precast Concrete
- Section 034900: Glass Fiber Reinforced Concrete (GFRC) Panels
- Section 044010: Gabion Site Walls
- Section 044200: Exterior Stone Cladding
- Section 051213: Architecturally Exposed Structural Steel (AESS)
- Section 064023: Architectural Woodwork
- Section 073360: Vegetated Roofing System
- Section 084113: Aluminum Framed Entrances and Structural Glass Curtain Walls
- Section 114800: Athletic and Recreational Equipment
- Section 321217: Aggregate Overlay Over Asphalt
- Section 321313: Concrete Paving
- Section 321314: Cast in Place Concrete Paving - Pervious
- Section 327200: Planting for Wetland Areas
- Section 334713: Wetland Liners

(2) Special experience requirements applicable to the contractor or subcontractor who will perform specific areas of work are summarized below. Such experience requirements are set forth in full in the Addendum to the General Conditions.

a. The contractor or subcontractor that will perform the specific areas of work specified above must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

b. For Section 073360 Vegetated Roofing System, the contractor or subcontractor performing the work of these sections must be a company regularly engaged in performing roofing projects with its own workforce and have successfully completed in a timely fashion at least three (3) roofing projects similar in scope, size and type to the required work within the last three (3) consecutive years prior to the bid opening. At least one of those projects must have been performed within the last twelve (12) months. The three (3) qualifying projects must have utilized one or more of the roofing systems specified for the project being bid herein, been installed by the contractor's or subcontractor's company utilizing its own workforce and must have qualified for, and have been issued, the warranty provided by the manufacturer of the roofing system. In addition, the contractor or subcontractor must be a certified or authorized installer for at least one of the manufacturer's roofing systems specified herein and shall submit proof of same.

(3) For each project submitted to demonstrate compliance with the special experience requirements for specific areas of work, the contractor or proposed subcontractor will be required to complete the Qualification Form included in the Bid Booklet.

a. The City will only evaluate a project if the following criteria are met: (1) the project is described on the Qualification Form, and (2) all information on the Qualification Form is provided. The City will not evaluate any project which does not comply with the criteria set forth herein, including any project which is referred to only on the resume of an individual.

b. For Section 073360 Vegetated Roofing System, the contractor or subcontractor must specify, for each qualifying project submitted, the type of roofing system utilized and provide proof that the manufacturer's warranty for that project was issued. The City will only evaluate a project if the following criteria are met: (1) the project is described on the Qualification Form, and (2) all information required to be provided by the contractor or subcontractor on the Qualification Form is actually provided. The City will not evaluate any project which does not comply with the criteria set forth herein, including any project which is referred to only on the resume of an individual.

(F) **EXPERIENCE REQUIREMENTS FOR MANUFACTURER(S)**: The special experience requirements set forth below apply to the manufacturer(s) that will supply or fabricate specific material or equipment. Compliance with such experience requirements will be evaluated after an award of contract. Within two (2) weeks of award, the contractor will be required to submit the qualifications of the proposed manufacturer(s). Once approved, no substitution will be permitted, unless the qualifications of the proposed replacement have been approved in writing in advance by the City.

(1) Special experience requirements apply to the manufacturer(s) of material and/or equipment specified in the section(s) set forth below.

General Construction

- Section 034500: Architectural Precast Concrete
- Section 034900: Glass Fiber Reinforced Concrete (GFRC) Panels
- Section 073360: Vegetated Roofing System
- Section 084113: Aluminum Framed Entrances and Structural Glass Curtain Walls
- Section 114800: Athletic and Recreational Equipment

(2) Special experience requirements applicable to the manufacturer(s) of specified material or equipment are summarized below. Such experience requirements are set forth in full in the Addendum to the General Conditions.

- The manufacturer providing the material or equipment specified in this section must, for the past five (5) years, have been regularly engaged in the manufacture of material or equipment similar in type to that required for this Project. Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years. In addition, for Architectural Precast Concrete, the manufacturer must be certified by the PreCast Institute (PCI).

Qualification Form

Project ID: CRO-AGS

List previous projects completed to meet the special experience requirements for this contract. Please photocopy this form for submission of all required projects.

Name of Contractor: C&L Contracting Corp.

Name of Project: Ocean Breaze Indoor Athletic Center - Contract 3

Location of Project: 625 Father Capodanno Blvd, Staten Island, NY

Owner or Owner's representative (Architect or Engineer) who is familiar with the work performed:

Name: Charlie Hernandez

Title: Project Manage Phone Number: 646.722.6279

Brief description of work completed: Interior fit-out of this new facility including, 2500 seats, 200m hydraulic banking track, High Jump , Shotput, Long Jump Stations, with toilets and locker rooms.

Was the work performed as a prime or a subcontractor: Prime

Amount of Contract: $ 50,660,000

Date of Completion: March 2015

****

Name of Contractor: C&L Ccontracting Corp.

Name of Project: Renovations of Bldg A, Snug arbor - Staten Island Muesum

Location of Project: 1000A Richmond Terrance, Staten Island, NY

Owner or Owner's representative (Architect or Engineer) who is familiar with the work performed:

Name: Rasem Addo

Title: Project Manager Phone Number: 646.404.6369

Brief description of work completed: Renovations and conversion of an existing landmark building, in Snug Harbor Cultural Center, into a museum for the Borough of Staten Island

Was the work performed as a prime or a subcontractor: Prime

Amount of Contract: $18,700,000

Date of Completion: January 2014

Qualification Form

Project ID: CRO-AGS

List previous projects completed to meet the special experience requirements for this contract. Please photocopy this form for submission of all required projects.

Name of Contractor: C&L Contracting Corp.

Name of Project: Museum of the City of New York - Phase II Renovations

Location of Project: 1220 Fifth Ave, New York, NY

Owner or Owner's representative (Architect or Engineer) who is familiar with the work performed:

Name: Susan Henshaw Jones

Title: Director of MCNY Phone Number: 917.492.3700

Brief description of work completed: Partial floor renovations of 5 floors, including 3 floor of galleries, full renovation of 3 additional floors, 2 of which were office space. Historic preservations including library wall panelling, ornamental iron restoration and replacement / replicates to wood windows, wood doors & steel windows.

Was the work performed as a prime or a subcontractor: Prime

Amount of Contract: $ 13,991,814

Date of Completion: November 2011

****

Name of Contractor: C&L Contracting Corp.

Name of Project: Engine Co. 259 Renovations

Location of Project: 33-51 Greenpoint Ave, Long Island City, NY

Owner or Owner's representative (Architect or Engineer) who is familiar with the work performed:

Name: Michael Mascaro

Title: Project Executive Phone Number: 347.386.3839

Brief description of work completed: Internal removal for building frame and replacement to allow for new requirements for fire fighting apparatus and equipment. Renovated space include kitchen, dinning, lounges, offices and training room. New sleeping quarters was constructed.

Was the work performed as a prime or a subcontractor: Prime

Amount of Contract: $ 6,884,399

Date of Completion: January 2009

Qualification Form

Project ID: CRO-AGS

List previous projects completed to meet the special experience requirements for this contract. Please photocopy this form for submission of all required projects.

Name of Contractor: C&L Contracting Corp.

Name of Project: Partial Reconstruction of Buildings F&G, Snug Harbor

Location of Project: 1000F Richmond Terrace, Staten Island , NY

Owner or Owner's representative (Architect or Engineer) who is familiar with the work performed:

Name: Tawfik Twafik

Title: Project Manager Phone Number: 917.731.7071

Brief description of work completed: Renovations of Bldg. G for new Day-care Facility. Renovations of Bldg. F for a new catering kitchen,including a passenger elevator and a large type dumbwaiter for food distributions.

Was the work performed as a prime or a subcontractor: Prime

Amount of Contract: $ 6,395,000

Date of Completion: February 2014

****

Name of Contractor: C&L Contracting Corp.

Name of Project: Central Park Police Precinct Renovations

Location of Project: 86 Transverse Road, New York, NY

Owner or Owner's representative (Architect or Engineer) who is familiar with the work performed:

Name: Phil Piscatella

Title: Project Executive Phone Number: 212.946.0391

Brief description of work completed: Restoration and Addition to the Central Park Police Precinct facility including masonry & stone restoration, cast iron, wood door historic restorations, along with historic hardware, and ecoustic tile restorations.

Was the work performed as a prime or a subcontractor: Prime

Amount of Contract: $ 32, 205,399

Date of Completion: February 2012

MWBE PROGRAM

M/WBE UTILIZATION PLAN

M/WBE Program Requirements: The requirements for the M/WBE Program are set forth on the following pages of this Bid Booklet, in the section entitled "Notice to All Prospective Contractors".

Schedule B: M/WBE Utilization Plan: Schedule B: M/WBE Utilization Plan for this Contract is set forth in this Bid Booklet on the pages following the section entitled "Notice to All Prospective Contractors". The M/WBE Utilization Plan (Part I) indicates whether Participation Goals have been established for this Contract. If Participation Goals have been established for this Contract, the bidder must submit an M/WBE Utilization Plan (Part II) with its bid.

Waiver: The bidder may seek a full or partial pre-award waiver of the Participation Goals in accordance with the "Notice to All Prospective Contractors" (See Part A, Section 10). The bidder's request for a waiver must be submitted at least seven (7) calendar days prior to the bid date. Waiver requests submitted after the deadline will not be considered. The form for requesting a waiver of the Participation Goals is set forth in the M/WBE Utilization Plan (Part III).

Rejection of the Bid: The bidder must complete Schedule B: M/WBE Utilization Plan (Part II) set forth in this Bid Booklet on the pages following the section entitled "Notice to All Prospective Contractors". A Schedule B submitted by the bidder which does not include the Vendor Certification and Required Affirmations (See Section V of Part II) will be deemed to be non-responsive, unless a full waiver of the Participation Goals is granted (Schedule B, Part III). In the event that the City determines that the bidder has submitted a Schedule B where the Vendor Certification and Required Affirmations are completed but other aspects of the Schedule B are not complete, or contain a copy or computation error that is at odds with the Vendor Certification and Required Affirmations, the bidder will be notified by the Agency and will be given four (4) calendar days from receipt of notification to cure the specified deficiencies and return a completed Schedule B to the Agency. Failure to do so will result in a determination that the Bid is non-responsive.

Receipt of notification is defined as the date notice is emailed or faxed (if the bidder has provided an email address or fax number), or no later than five (5) days from the date of mailing or upon delivery, if delivered.

Impact on LBE Requirements: If Participation Goals have been established for the participation of M/WBEs, the contractor is not required to comply with the Locally Based Enterprise Program ("LBE"). The LBE Program is set forth in Article 67 of the Contract.

THIS PAGE INTENTIONALLY LEFT BLANK

NOTICE TO ALL PROSPECTIVE CONTRACTORS

PARTICIPATION BY MINORITY-OWNED AND WOMEN-OWNED BUSINESS ENTERPRISES IN CITY PROCUREMENT

ARTICLE I. M/WBE PROGRAM

Local Law No. 129 of 2005 added and Local Law 1 of 2013 amended Section 6-129 of the Administrative Code of the City of New York (hereinafter "Section 6-129"). Section 6-129 establishes the program for participation in City procurement ("M/WBE Program") by minority- owned business enterprises ("MBEs") and women-owned business enterprises ("WBEs"), certified in accordance with Section 1304 of the New York City Charter. As stated in Section 6¬-129, the intent of the program is to address the impact of discrimination on the City's procurement process, and to promote the public interest in avoiding fraud and favoritism in the procurement process, increasing competition for City business, and lowering contract costs. The contract provisions contained herein are pursuant to Section 6-129, and the rules of the Department of Small Business Services ("DSBS") promulgated thereunder.

If this Contract is subject to the M/WBE Program established by Section 6-129, the specific requirements of MBE and/or WBE participation for this Contract are set forth in Schedule B of the Contract (entitled the "M/WBE Utilization Plan"), and are detailed below. The Contractor must comply with all applicable MBE and WBE requirements for this Contract.

All provisions of Section 6-129 are hereby incorporated in the Contract by reference and all terms used herein that are not defined herein shall have the meanings given such terms in Section 6-129. Article I, Part A, below, sets forth provisions related to the participation goals for construction, standard and professional services contracts. Article I, Part B, below, sets forth miscellaneous provisions related to the M/WBE Program.

PART A

PARTICIPATION GOALS FOR CONSTRUCTION, STANDARD AND PROFESSIONAL SERVICES CONTRACTS OR TASK ORDERS

1. The **MBE and/or WBE Participation Goals** established for this Contract or Task Orders issued pursuant to this Contract, ("Participation Goals"), as applicable, are set forth on Schedule B, Part I to this Contract (see Page 1, line 1 Total Participation Goals) or will be set forth on Schedule B, Part I to Task Orders issued pursuant to this Contract, as applicable.

The **Participation Goals** represent a percentage of the total dollar value of the Contract or Task Order, as applicable, that may be achieved by awarding subcontracts to firms certified with New York City Department of Small Business Services as MBEs and/or WBEs, and/or by crediting the participation of prime contractors and/or qualified joint ventures as provided in Section 3 below, unless the goals have been waived or modified by Agency in accordance with Section 6¬-129 and Part A, Sections 10 and 11 below, respectively.

2. If **Participation Goals** have been established for this Contract or Task Orders issued pursuant to this Contract, Contractor agrees or shall agree as a material term of the Contract that Contractor shall be subject to the **Participation Goals,** unless the goals are waived or modified by Agency in accordance with Section 6-129 and Part A, Sections 10 and 11 below, respectively.

3. If **Participation Goals** have been established for this Contract or Task Order issued pursuant to this Contract, a Contractor that is an MBE and/or WBE shall be permitted to count its own participation toward fulfillment of the relevant **Participation Goal**, provided that in accordance with Section 6-129 the value of Contractor's participation shall be determined by subtracting from the total value of the Contract or Task Order, as applicable, any amounts that the Contractor pays to direct subcontractors (as defined in Section 6-129(c)(13)), and provided further that a Contractor that is certified as both an MBE and a WBE may count its own participation either toward the goal for MBEs or the goal for WBEs, but not both.

A Contractor that is a qualified joint venture (as defined in Section 6-129(c)(30)) shall be permitted to count a percentage of its own participation toward fulfillment of the relevant **Participation Goal**. In accordance with Section 6-129, the value of Contractor's participation shall be determined by subtracting from the total value of the Contract or Task Order, as applicable, any amounts that Contractor pays to direct subcontractors, and then multiplying the remainder by the percentage to be applied to total profit to

determine the amount to which an MBE or WBE is entitled pursuant to the joint venture agreement, provided that where a participant in a joint venture is certified as both an MBE and a WBE, such amount shall be counted either toward the goal for MBEs or the goal for WBEs, but not both.

4. A. If **Participation Goals** have been established for this Contract, a prospective contractor shall be required to submit with its bid or proposal, as applicable, a completed Schedule B, M/WBE Utilization Plan, Part II (see Pages 2-4) indicating: (a) whether the contractor is an MBE or WBE, or qualified joint venture; (b) the percentage of work it intends to award to direct subcontractors; and (c) in cases where the contractor intends to award direct subcontracts, a description of the type and dollar value of work designated for participation by MBEs and/or WBEs, and the time frames in which such work is scheduled to begin and end. In the event that this M/WBE Utilization Plan indicates that the bidder or proposer, as applicable, does not intend to meet the **Participation Goals**, the bid or proposal, as applicable, shall be deemed non-responsive, unless Agency has granted the bidder or proposer, as applicable, a pre- award waiver of the Participation Goals in accordance with Section 6-129 and Part A, Section 10 below.

B. (i) If this Contract is for a master services agreement or other requirements type contract that will result in the issuance of Task Orders that will be individually registered ("Master Services Agreement") and is subject to M/WBE **Participation Goals**, a prospective contractor shall be required to submit with its bid or proposal, as applicable, a completed Schedule B, M/WBE Participation Requirements for Master Services Agreements That Will Require Individually Registered Task Orders, Part II (page 2) indicating the prospective contractor's certification and required affirmations to make all reasonable good faith efforts to meet participation goals established on each individual Task Order issued pursuant to this Contract, or if a partial waiver is obtained or such goals are modified by the Agency, to meet the modified **Participation Goals** by soliciting and obtaining the participation of certified MBE and/or WBE firms. In the event that the Schedule B indicates that the bidder or proposer, as applicable, does not intend to meet the **Participation Goals** that may be established on Task Orders issued pursuant to this Contract, the bid or proposal, as applicable, shall be deemed non¬responsive.

(ii) **Participation Goals** on a Master Services Agreement will be established for individual Task Orders issued after the Master Services Agreement is awarded. If **Participation Goals** have been established on a Task Order, a contractor shall be required to submit a Schedule B – M/WBE Utilization Plan For Independently Registered Task Orders That Are Issued Pursuant to Master Services Agreements, Part II (see Pages 2-4) indicating: (a) whether the contractor is an MBE or WBE, or qualified joint venture; (b) the percentage of work it intends to award to direct subcontractors; and (c) in cases where the contractor intends to award direct subcontracts, a description of the type and dollar value of work designated for participation by MBEs and/or WBEs, and the time frames in which such work is scheduled to begin and end. The contractor must engage in good faith efforts to meet the **Participation Goals** as established for the Task Order unless Agency has granted the contractor a pre-award waiver of the Participation Goals in accordance with Section 6-129 and Part A, Section 10 below.

C. THE BIDDER/PROPOSER MUST COMPLETE THE SCHEDULE B INCLUDED HEREIN (SCHEDULE B, PART II). A SCHEDULE B SUBMITTED BY THE BIDDER/PROPOSER WHICH DOES NOT INCLUDE THE VENDOR CERTIFICATION AND REQUIRED AFFIRMATIONS (SEE SECTION V OF PART II) WILL BE DEEMED TO BE NON-RESPONSIVE, UNLESS A FULL WAIVER OF THE PARTICIPATION GOALS IS GRANTED (SCHEDULE B, PART III). IN THE EVENT THAT THE CITY DETERMINES THAT THE BIDDER/PROPOSER HAS SUBMITTED A SCHEDULE B WHERE THE VENDOR CERTIFICATION AND REQUIRED AFFIRMATIONS ARE COMPLETED BUT OTHER ASPECTS OF THE SCHEDULE B ARE NOT COMPLETE, OR CONTAIN A COPY OR COMPUTATION ERROR THAT IS AT ODDS WITH THE VENDOR CERTIFICATION AND AFFIRMATIONS, THE BIDDER/PROPOSER WILL BE NOTIFIED BY THE AGENCY AND WILL BE GIVEN FOUR (4) CALENDAR DAYS FROM RECEIPT OF NOTIFICATION TO CURE THE SPECIFIED DEFICIENCIES AND RETURN A COMPLETED SCHEDULE B TO THE AGENCY. FAILURE TO DO SO WILL RESULT IN A DETERMINATION THAT THE BID/PROPOSAL IS NON-RESPONSIVE. RECEIPT OF NOTIFICATION IS DEFINED AS THE DATE NOTICE IS E-MAILED OR FAXED (IF THE BIDDER/PROPOSER HAS PROVIDED AN E-MAIL ADDRESS OR FAX NUMBER), OR NO LATER THAN FIVE (5) CALENDAR DAYS FROM THE DATE OF MAILING OR UPON DELIVERY, IF DELIVERED.

5. Where an **M/WBE** Utilization Plan has been submitted, the Contractor shall, within 30 days of issuance by Agency of a notice to proceed, submit a list of proposed persons or entities to which it intends to award subcontracts within the subsequent 12 months. In the case of multi¬year contracts, such list shall also be submitted every year thereafter. The Agency may also require the Contractor to report periodically about the contracts awarded by its direct subcontractors to indirect subcontractors (as defined in Section 6-129(c)(22)). **PLEASE NOTE: If this Contract is a public works project subject to GML §101(5) (i.e., a contract valued at or**

below $3M for projects in New York City) or if the Contract is subject to a project labor agreement in accordance with Labor Law §222, and the bidder is required to identify at the time of bid submission its intended subcontractors for the Wicks trades (plumbing and gas fitting; steam heating, hot water heating, ventilating and air conditioning (HVAC); and electric wiring), the Contractor must identify all those to which it intends to award construction subcontracts for any portion of the Wicks trade work at the time of bid submission, regardless of what point in the life of the contract such subcontracts will occur. In identifying intended subcontractors in the bid submission, bidders may satisfy any Participation Goals established for this Contract by proposing one or more subcontractors that are MBEs and/or WBEs for any portion of the Wicks trade work. In the event that the Contractor's selection of a subcontractor is disapproved, the Contractor shall have a reasonable time to propose alternate subcontractors.

6. MBE and WBE firms must be certified by DSBS in order for the Contractor to credit such firms' participation toward the attainment of the **Participation Goals**. Such certification must occur prior to the firms' commencement of work. A list of MBE and WBE firms may be obtained from the DSBS website at www.nyc.gov/buycertified, by emailing DSBS at buyer@sbs.nyc.gov, by calling (212) 513-6356, or by visiting or writing DSBS at 110 William St., New York, New York, 10038, 7th floor. Eligible firms that have not yet been certified may contact DSBS in order to seek certification by visiting www.nyc.gov/getcertified, emailing MWBE@sbs.nyc.gov, or calling the DSBS certification helpline at (212) 513-6311. A firm that is certified as both an MBE and a WBE may be counted either toward the goal for MBEs or the goal for WBEs, but not both. No credit shall be given for participation by a graduate MBE or graduate WBE, as defined in Section 6-129(c)(20).

7. Where an **M/WBE** Utilization Plan has been submitted, the Contractor shall, with each voucher for payment, and/or periodically as Agency may require, submit statements, certified under penalty of perjury, which shall include, but not be limited to,: the total amount the Contractor paid to its direct subcontractors, and, where applicable pursuant to Section 6-129(j), the total amount direct subcontractors paid to indirect subcontractors; the names, addresses and contact numbers of each MBE or WBE hired as a subcontractor by the Contractor, and, where applicable, hired by any of the Contractor's direct subcontractors; and the dates and amounts paid to each MBE or WBE. The Contractor shall also submit, along with its voucher for final payment: the total amount it paid to subcontractors, and, where applicable pursuant to Section 6-129(j), the total amount its direct subcontractors paid directly to their indirect subcontractors; and a final list, certified under penalty of perjury, which shall include the name, address and contact information of each subcontractor that is an MBE or WBE, the work performed by, and the dates and amounts paid to each.

8. If payments made to, or work performed by, MBEs or WBEs are less than the amount specified in the Contractor's **M/WBE** Utilization Plan, Agency shall take appropriate action, in accordance with Section 6-129 and Article II below, unless the Contractor has obtained a modification of its **M/WBE** Utilization Plan in accordance with Section 6-129 and Part A, Section 11 below.

9. Where an **M/WBE** Utilization Plan has been submitted, and the Contractor requests a change order the value of which exceeds the greater of 10 percent of the Contract or Task Order, as applicable, or $500,000, Agency shall review the scope of work for the Contract or Task Order, as applicable, and the scale and types of work involved in the change order, and determine whether the **Participation Goals** should be modified.

10. Pre-award waiver of the **Participation Goals.** (a) A bidder or proposer, or contractor with respect to a Task Order, may seek a pre-award full or partial waiver of the **Participation Goals** in accordance with Section 6-129, which requests that Agency change one or more **Participation Goals** on the grounds that the **Participation Goals** are unreasonable in light of the availability of certified firms to perform the services required, or by demonstrating that it has legitimate business reasons for proposing a lower level of subcontracting in its M/WBE Utilization Plan.

(b) To apply for a full or partial waiver of the **Participation Goals**, a bidder, proposer, or contractor, as applicable, must complete Part III (Page 5) of Schedule B and submit such request no later than seven (7) calendar days prior to the date and time the bids, proposals, or Task Orders are due, in writing to the Agency by email at zhangji@ddc.nyc.gov or via facsimile at (718) 391-1886. Bidders, proposers, or contractors, as applicable, who have submitted requests will receive an Agency response by no later than two (2) calendar days prior to the due date for bids, proposals, or Task Orders; provided, however, that if that date would fall on a weekend or holiday, an Agency response will be provided by close-of-business on the business day before such weekend or holiday date.

(c) If the Agency determines that the **Participation Goals** are unreasonable in light of the availability of certified firms to perform the services required, it shall revise the solicitation and extend the deadline for bids and proposals, or revise the Task Order, as applicable.

(d) Agency may grant a full or partial waiver of the Participation Goals to a bidder, proposer or contractor, as applicable, who demonstrates—before submission of the bid, proposal or Task Order, as applicable—that it has legitimate business reasons for proposing the level of subcontracting in its M/WBE Utilization Plan. In making its determination, Agency shall consider factors that shall include but not be limited to, whether the bidder, proposer or contractor, as applicable, has the capacity and the bona fide intention to perform Contract without any subcontracting, or to perform the Contract without awarding the amount of subcontracts represented by the Participation Goals. In making such determination, Agency may consider whether the M/WBE Utilization Plan is consistent with past subcontracting practices of the bidder, proposer or contractor, as applicable, whether the bidder, proposer or contractor, as applicable, has made efforts to form a joint venture with a certified firm, and whether the bidder, proposer, or contractor, as applicable, has made good faith efforts to identify other portions of the Contract that it intends to subcontract.

11. Modification of M/WBE Utilization Plan. (a) A Contractor may request a modification of its M/WBE Utilization Plan after award of this Contract. PLEASE NOTE: If this Contract is a public works project subject to GML §101(5) (i.e., a contract valued at or below $3M for projects in New York City) or if the Contract is subject to a project labor agreement in accordance with Labor Law §222, and the bidder is required to identify at the time of bid submission its intended subcontractors for the Wicks trades (plumbing and gas fitting; steam heating, hot water heating, ventilating and air conditioning (HVAC); and electric wiring), the Contractor may request a Modification of its M/WBE Utilization Plan as part of its bid submission. The Agency may grant a request for Modification of a Contractor's M/WBE Utilization Plan if it determines that the Contractor has established, with appropriate documentary and other evidence, that it made reasonable, good faith efforts to meet the Participation Goals. In making such determination, Agency shall consider evidence of the following efforts, as applicable, along with any other relevant factors:

(i) The Contractor advertised opportunities to participate in the Contract, where appropriate, in general circulation media, trade and professional association publications and small business media, and publications of minority and women's business organizations;

(ii) The Contractor provided notice of specific opportunities to participate in the Contract, in a timely manner, to minority and women's business organizations;

(iii) The Contractor sent written notices, by certified mail or facsimile, in a timely manner, to advise MBEs or WBEs that their interest in the Contract was solicited;

(iv) The Contractor made efforts to identify portions of the work that could be substituted for portions originally designated for participation by MBEs and/or WBEs in the M/WBE Utilization Plan, and for which the Contractor claims an inability to retain MBEs or WBEs;

(v) The Contractor held meetings with MBEs and/or WBEs prior to the date their bids or proposals were due, for the purpose of explaining in detail the scope and requirements of the work for which their bids or proposals were solicited;

(vi) The Contractor made efforts to negotiate with MBEs and/or WBEs as relevant to perform specific subcontracts, or act as suppliers or service providers;

(vii) Timely written requests for assistance made by the Contractor to Agency's M/WBE liaison officer and to DSBS;

(viii) Description of how recommendations made by DSBS and Agency were acted upon and an explanation of why action upon such recommendations did not lead to the desired level of participation of MBEs and/or WBEs.

Agency's M/WBE officer shall provide written notice to the Contractor of the determination.

(b) The Agency may modify the **Participation Goals** when the scope of the work has been changed by the Agency in a manner that affects the scale and types of work that the Contractor indicated in its **M/WBE** Utilization Plan would be awarded to subcontractors.

12. If this Contract is for an indefinite quantity of construction, standard or professional services or is a requirements type contract and the Contractor has submitted an **M/WBE** Utilization Plan and has committed to subcontract work to MBEs and/or WBEs in order to meet the **Participation Goals**, the Contractor will not be deemed in violation of the M/WBE Program requirements for this Contract with regard to any work which was intended to be subcontracted to an MBE and/or WBE to the extent that the Agency has determined that such work is not needed.

13. If **Participation Goals** have been established for this Contract or a Task Order issued pursuant to this Contract, at least once annually during the term of the Contract or Task Order, as applicable, Agency shall review the Contractor's progress toward attainment of its M/WBE Utilization Plan, including but not limited to, by reviewing the percentage of work the Contractor has actually awarded to MBE and/or WBE subcontractors and the payments the Contractor made to such subcontractors.

14. If **Participation Goals** have been established for this Contract or a Task Order issued pursuant to this Contract, Agency shall evaluate and assess the Contractor's performance in meeting those goals, and such evaluation and assessment shall become part of the Contractor's overall contract performance evaluation.

PART B: MISCELLANEOUS

1. The Contractor shall take notice that, if this solicitation requires the establishment of an **M/WBE** Utilization Plan, the resulting contract may be audited by DSBS to determine compliance with Section 6-129. See §6-129(e)(10). Furthermore, such resulting contract may also be examined by the City's Comptroller to assess compliance with the **M/WBE** Utilization Plan.

2. Pursuant to DSBS rules, construction contracts that include a requirement for an **M/WBE** Utilization Plan shall not be subject to the law governing Locally Based Enterprises set forth in Section 6-108.1 of the Administrative Code of the City of New York.

3. DSBS is available to assist contractors and potential contractors in determining the availability of MBEs and/or WBEs to participate as subcontractors, and in identifying opportunities that are appropriate for participation by MBEs and/or WBEs in contracts.

4. Prospective contractors are encouraged to enter into qualified joint venture agreements with MBEs and/or WBEs as defined by Section 6-129(c)(30).

5. By submitting a bid or proposal the Contractor hereby acknowledges its understanding of the M/WBE Program requirements set forth herein and the pertinent provisions of Section 6-129, and any rules promulgated thereunder, and if awarded this Contract, the Contractor hereby agrees to comply with the M/WBE Program requirements of this Contract and pertinent provisions of Section 6-129, and any rules promulgated thereunder, all of which shall be deemed to be material terms of this Contract. The Contractor hereby agrees to make all reasonable, good faith efforts to solicit and obtain the participation of MBEs and/or WBEs to meet the required **Participation Goals.**

ARTICLE II. ENFORCEMENT

1. If Agency determines that a bidder or proposer, as applicable, has, in relation to this procurement, violated Section 6-129 or the DSBS rules promulgated pursuant to Section 6-129, Agency may disqualify such bidder or proposer, as applicable, from competing for this Contract and the Agency may revoke such bidder's or proposer's prequalification status, if applicable.

2. Whenever Agency believes that the Contractor or a subcontractor is not in compliance with Section 6-129 or the DSBS rules promulgated pursuant to Section 6-129, or any provision of this Contract that implements Section 6-129, including, but not limited to any **M/WBE** Utilization Plan, Agency shall send a written notice to the Contractor describing the alleged noncompliance and offering the Contractor an opportunity to be heard. Agency shall then conduct an investigation to determine whether such Contractor or subcontractor is in compliance.

3. In the event that the Contractor has been found to have violated Section 6-129, the DSBS rules promulgated pursuant to Section 6-129, or any provision of this Contract that implements Section 6-129, including, but not limited to, any **M/WBE** Utilization Plan, Agency may determine that one of the following actions should be taken:

(a) entering into an agreement with the Contractor allowing the Contractor to cure the violation;
(b) revoking the Contractor's pre-qualification to bid or make proposals for future contracts;
(c) making a finding that the Contractor is in default of the Contract;
(d) terminating the Contract;
(e) declaring the Contractor to be in breach of Contract;
(f) withholding payment or reimbursement;
(g) determining not to renew the Contract;
(h) assessing actual and consequential damages;

(i) assessing liquidated damages or reducing fees, provided that liquidated damages may be based on amounts representing costs of delays in carrying out the purposes of the M/WBE Program, or in meeting the purposes of the Contract, the costs of meeting utilization goals through additional procurements, the administrative costs of investigation and enforcement, or other factors set forth in the Contract;
(j) exercising rights under the Contract to procure goods, services or construction from another contractor and charge the cost of such contract to the Contractor that has been found to be in noncompliance; or
(k) taking any other appropriate remedy.

4. If an **M/WBE** Utilization Plan has been submitted, and pursuant to this Article II, Section 3, the Contractor has been found to have failed to fulfill its **Participation Goals** contained in its **M/WBE** Utilization Plan or the **Participation Goals** as modified by Agency pursuant to Article I, Part A, Section 11, Agency may assess liquidated damages in the amount of ten percent (10%) of the difference between the dollar amount of work required to be awarded to MBE and/or WBE firms to meet the **Participation Goals** and the dollar amount the Contractor actually awarded and paid, and/or credited, to MBE and/or WBE firms. In view of the difficulty of accurately ascertaining the loss which the City will suffer by reason of Contractor's failure to meet the **Participation Goals**, the foregoing amount is hereby fixed and agreed as the liquidated damages that the City will suffer by reason of such failure, and not as a penalty. Agency may deduct and retain out of any monies which may become due under this Contract the amount of any such liquidated damages; and in case the amount which may become due under this Contract shall be less than the amount of liquidated damages suffered by the City, the Contractor shall be liable to pay the difference.

5. Whenever Agency has reason to believe that an MBE and/or WBE is not qualified for certification, or is participating in a contract in a manner that does not serve a commercially useful function (as defined in Section 6-129(c)(8)), or has violated any provision of Section 6- 129, Agency shall notify the Commissioner of DSBS who shall determine whether the certification of such business enterprise should be revoked.

6. Statements made in any instrument submitted to Agency pursuant to Section 6-129 shall be submitted under penalty of perjury and any false or misleading statement or omission shall be grounds for the application of any applicable criminal and/or civil penalties for perjury. The making of a false or fraudulent statement by an MBE and/or WBE in any instrument submitted pursuant to Section 6-129 shall, in addition, be grounds for revocation of its certification.

7. The Contractor's record in implementing its **M/WBE** Utilization Plan shall be a factor in the evaluation of its performance. Whenever Agency determines that a Contractor's compliance with an **M/WBE** Utilization Plan has been unsatisfactory, Agency shall, after consultation with the City Chief Procurement Officer, file an advice of caution form for inclusion in VENDEX as caution data.

Tax ID #: 11-2790353

APT E-PIN#: 85018B0040

Contract # 1 - General Construction Work

SCHEDULE B - M/WBE Utilization Plan

Part I: M/WBE Participation Goals

Part I to be completed by contracting agency

Contract Overview

APT E-Pin #	85018B0040	**FMS Project ID#:**	CRO-AGS
Project Title/Agency	Croton New Above Ground Structure and Landscaping		
PIN #	8502018CT0001C		
Bid/Proposal Response Date:	FEBRUARY 1, 2018 - 1 March 2018		
Contracting Agency	Department of Design and Construction		
Agency Address	30-30 Thomson Avenue **City** Long Island City **State** NY **Zip Code** 11101		
Contact Person	Noelia Guzman **Title** MWBE Liaison & Compliance Analyst		
Telephone #	(718) 391-2198 **Email** guzmanno@ddc.nyc.gov		

Project Description *(attach additional pages if necessary)*

This Project consists of a clubhouse and landscape features for the Mosholu Golf Course, a Wetland Cell System which filters storm water and groundwater for re-use by the golf course irrigation system, and Security Features which protect the adjacent DEP Croton Water Treatment Plant facility. The entire site is located within Van Courtland Park and the aim of the project is to integrate the new facility into the surrounding landscape. Design & construction of the project is required to comply with New York City Local Law 86 as the energy performance benchmark and must qualify for LEED Silver certification or higher. All construction trades will be required to contribute to the energy performance, sustainability, and LEED goals of the project.

M/WBE Participation Goals for Services

Enter the percentage amount for each group or for an unspecified goal. Please note that there are no goals for Asian Americans in Professional Services

Prime Contract Industry: **Construction**

Group	Percentage		
Unspecified *	**23**	%	
or			
Black American	**Unspecified**	%	
Hispanic American	**Unspecified**	%	
Asian American	**Unspecified**	%	
Women	**Unspecified**	%	
Total Participation Goals	**23**	%	**Line 1**

* Note: For this procurement, individual ethnicity and gender goals are not specified. The Total Participation Goals for construction contracts may be met by using Black American, Hispanic American,Asian American or Women certified firms or any combination of such firms.

Tax ID #: 11-2790353 APT E-

PIN#: 85018B0040

SCHEDULE B - Part II: M/WBE Participation Plan

Part II to be completed by the bidder/proposer:

Please note: For Non-M/WBE Prime Contractors who will NOT subcontract any services and will self-perform the entire contract, you must obtain a FULL waiver by completing the Waiver Application on pages 9 and 9a and timely submitting it to the contracting agency pursuant to the Notice to Prospective Contractors. Once a FULL WAIVER is granted, it must be included with your bid or proposal and you do not have to complete or submit this form with your bid or proposal.

Section I: Prime Contractor Contact Information

Tax ID #	11-2790353	**FMS Vendor ID #**	
Business Name	C&L Contracting Corp.	**Contact Person**	Tony Massaro
Address	1981 Marcus Ave., Suite E106, Lake Success, NY 11042		
Telephone #	516.326.4460	**Email**	amassaro@clcont.com

Section II: M/WBE Utilization Goal Calculation: Check the applicable box and complete subsection.

PRIME CONTRACTOR ADOPTING AGENCY M/WBE PARTICIPATION GOALS

☒ For Prime Contractors (including Qualified Joint Ventures and M/WBE firms) adopting Agency M/WBE Participation Goals.	Total Bid/Proposal Value		Agency Total Participation Goals (Line 1, Page 6)		Calculated M/WBE Participation Amount
Calculate the total dollar value of your total bid that you agree will be awarded to M/WBE subcontractors for services and/or credited to an M/WBE prime contractor or Qualified Joint Venture. Please review the Notice to Prospective Contractors for more information on how to obtain credit for M/WBE participation.	$ 84,574,604	X	23%	=	$ 19,452,159 Line 2

PRIME CONTRACTOR OBTAINED PARTIAL WAIVER APPROVAL: ADOPTING MODIFIED M/WBE PARTICIPATION GOALS

☐ For Prime Contractors (including Qualified Joint Ventures and M/WBE firms) adopting Modified M/WBE Participation Goals.	Total Bid/Proposal Value		Adjusted Participation Goal (From Partial Waiver)		Calculated M/WBE Participation Amount
Calculate the total dollar value of your total bid that you agree will be awarded to M/WBE subcontractors for services and/or credited to an M/WBE prime contractor or Qualified Joint Venture. Please review the Notice to Prospective Contractors for more information on how to obtain credit for M/WBE participation.	$	X		=	$ Line 3

Tax ID #: 11-2790353

APT E-PIN#: 85018B0040

Section III: M/WBE Utilization Plan: How Proposer/Bidder Will Fulfill M/WBE Participation Goals. Please review the Notice to Prospective Contractors for more information on how to obtain credit for M/WBE participation. Check applicable box. The Proposer or Bidder will fulfill the M/WBE Participation Goals:

☐ As an M/WBE Prime Contractor that will self-perform and/or subcontract to other M/WBE firms a portion of the contract the value of which is at least the amount located on Lines 2 or 3 above, as applicable. The value of any work subcontracted to non-M/WBE firms will not be credited towards fulfillment of M/WBE Participation Goals. Please check all that apply to Prime Contractor:

☐ MBE ☐ WBE

☐ As a Qualified Joint Venture with an M/WBE partner, in which the value of the M/WBE partner's participation and/or the value of any work subcontracted to other M/WBE firms is at least the amount located on Lines 2 or 3 above, as applicable. The value of any work subcontracted to non M/WBE firms will not be credited towards fulfillment of M/WBE Participation Goals.

☒ As a non M/WBE Prime Contractor that will enter into subcontracts with M/WBE firms the value of which is at least the amount located on Lines 2 or 3 above, as applicable.

Section IV: General Contract Information

What is the expected percentage of the total contract dollar value that you expect to award in subcontracts for services, regardless of M/WBE status? % 23

✓ Scopes of Subcontract Work

Enter brief description of the type(s) and dollar value of subcontracts for all any services you plan on subcontracting if awarded this contract. For each item, indicate whether the work is designated for participation by MBEs and/or WBEs and the time frame in which such work is scheduled to begin and end. Use additional sheets if necessary.

1. See Attached Sheets
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.

Section V: Vendor Certification and Required Affirmations

I hereby:

1) acknowedge my understanding of the M/WBE participation requirements as set forth herein and the pertinent provisions of Section 6-129 of the Administrative Code of the City of New Yo9rk (Section 6-129), and the rules promulgated thereunder;

2) affirm that the information supplied in support of this M/WBE Utilization Plan is true and correct;

3) agree, if awarded this Contract, to comply with the M/WBE participation requirements of this Contract, the pertinent provisions of Section 6-129, and the rules promulgated thereunder, all of which shall be deemed to be material terms of this Contract

4) agree and affirm that it is a maerial term of this Contract that the Vendor will award the total dollar value of the M/WBE Participation Goals to certified MBEs and/or WBEs, unless a full waiver is obtained or such goals are modfied by the Agency; and

5) agree and affirm, if awarded this Contract, to make all reasonable, good faith efforts to meet the M/WBE Participation Goals, or if a partial waiver is obtained or such goals are modified by the Agency, to meet the modified Participation Goals by soliciting and obtaining the participation of certified MBE and/or WBE firms.

Signature [signature] Date 1 March 2018

Print Name Tony Massaro Title Secretary / Treasurer

Croton Above Grade Structure and Landscape Construction ---

NYC DDC [NYC Parks // NYDEP]

C&L Contracting Corp.

Bid Due: ***Thursday, March 01, 2018***

Trade	M/WBE		Value
Security		$	529,536
Concrete Polishing		$	21,754
Precast Concrete		$	3,926,836
Masonry		$	1,324,499
Steel		$	4,891,611
Ornamental Steel		$	5,950,810
Architectural Woodwork		$	458,407
Waterproofing	WBE	$	229,987
Spray Insulation		$	203,906
Vegetated Roof	WBE	$	1,026,803
Spray Fireproofing		$	85,676
Door-Frames-Hardware		$	39,994
Overhead Doors		$	34,600
Aluminun and Glass Systems		$	3,539,960
Tile		$	76,750
Carpeting		$	32,321
Painting		$	122,663
Toilet Partitions & Accessories		$	17,505
Operable Partition		$	53,980
Flagpole		$	13,834
Parking Access Control		$	21,235
Athletic Equipment		$	323,597
Wiindow Treatment		$	23,970
Tensioned Fabric Structures		$	1,788,362
Fire Sprinklers		$	225,000
Plumbing	WBE	$	2,204,825
HVAC		$	2,204,721
Electrical		$	3,009,000
Earthwork	MBE	$	6,549,498
Asphalt Pavements	MBE	$	627,506
Landscaping	WBE	$	4,387,670
Irrigation	WBE	$	744,562
Fencing		$	52,230
Site Utilities	MBE	$	2,717,175
TOTAL		$	47,460,783

#1

#1

BID FORM
THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

BID FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

PROJECT ID: CRO-AGS

Croton New Above Ground Structure and Landscaping Rebid
3651 Jerome Avenue
Bronx, NY 10467

Name of Bidder: C&L Contracting Corp.

Date of Bid Opening: 1 March 2018

Bidder is: (Check one, whichever applies) Individual ( ) Partnership ( ) Corporation (X)

Place of Business of Bidder: 1981 Marcus Ave, Suite E106, Lake Success, NY 11042

Bidder's Telephone Number: 516.326.4460 Bidder's Fax Number: 516.326.4480

Bidder's Email Address: amassaro@clcont.com

Residence of Bidder (If Individual): _____

If Bidder is a Partnership, fill in the following blanks:

Names of Partners	Residence of Partners

If Bidder is a Corporation, fill in the following blanks:
Organized under the laws of the State of New York

Name and Home Address of President: Manual Santos
14 Nichols Road, Armonk, NY 10504

Name and Home Address of Secretary: Tony Massaro
194 West Shore Drive, Massapequa, NY 11758

Name and Home Address of Treasurer: Tony Massaro
194 West Shore Drive, Massapequa, NY 11758

BID FORM

C&L Contracting Corp.

The above-named Bidder affirms and declares:

1. The said bidder is of lawful age and the only one interested in this bid; and no person, firm or corporation other than hereinbefore named has any interest in this bid, or in the Contract proposed to be taken.

2. By submission of this bid, each bidder and each person signing on behalf of any bidder certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief: (1) the prices in this bid have been arrived at independently without collusion, consultation, communication or agreement, for the purpose of restricting competition, as to any matter relating to such prices with any other bidder or with any competitor; (2) unless otherwise required by law, the prices quoted in this bid have not been knowingly disclosed by the bidder and will not knowingly be disclosed by the bidder prior to opening, directly or indirectly, to any other bidder or to any competitor; and (3) no attempt has been made or will be made by the bidder to induce any other person, partnership or corporation to submit or not to submit a bid for the purpose of restricting competition.

3. No councilman or other officer or employee or person whose salary is payable in whole or in part from the City Treasury is directly or indirectly interested in this bid, or in the supplies, materials, equipment, work or labor to which it relates, or in any of the profits thereof.

4. The bidder is not in arrears to the City of New York upon debt or contract or taxes, and is not a defaulter, as surety or otherwise, upon any obligation of the CIty of New York, and has not been declared not responsible, or disqualified, by any agency of the City of New York or State of New York, nor is there any proceeding pending relating to the responsibility or qualification of the bidder to receive public contracts except as set forth on the Affirmation included as page 17 of this Bid Booklet.

The bidder hereby affirms that is has paid all applicable City income, excise and other taxes for all years it has conducted business activities in New York City.

5. The bidder, as an individual, or as a member, partner, director or officer of the bidder, if the same be a firm, partnership or corporation, executes this document expressly warranting and representing that should this bid be accepted by the City and the Contract awarded to him, he and his subcontractors engaged in the performance: (1) will comply with the provisions of Section 6-108 of the Administrative Code of the City of New York and the non-discrimination provisions of Section 220a of the New York State Labor Law, as more expressly and in detail set forth in the Agreement; (2) will comply with Section 6-109 of the Administrative Code of the City of New York in relation to minimum wages and other stipulations as more expressly and in detail set forth in the Agreement; (3) have complied with the provisions of the aforesaid laws since their respective effective dates, and (4) will post notices to be furnished by the City, setting forth the requirements of the aforesaid laws in prominent and conspicuous places in each and every plant, factory, building and structure where employees engaged in the performance of the Contract can readily view it, and will continue to keep such notices posted until the supplies, materials and equipment, or work labor and services required to be furnished or rendered by the Contractor have been finally accepted by the City. In the event of any breach or violation of the foregoing, the Contractor may be subject to damages, liquidated or otherwise, cancellation of the Contract and suspension as a bidder for a period of three years. (The words, "the bidder", "he", "his", and "him" where used shall mean the individual bidder, firm, partnership or corporation executing this bid).

6. Compliance Report

The bidder, as an individual, or as a member, partner, director, or officer of the bidder, if the same be a firm, partnership, or corporation, (1) represents that his attention has been specifically drawn to Executive Order No. 50, dated April 25, 1980, on Equal Employment Compliance of the contract, and (2) warrants that he will comply with the provisions of Executive Order No. 50. The Employment Report must be submitted as part of the bid.

The bidder, as an individual, or as a member, partner, director, or officer of the bidder, if the same be a firm, partnership, or corporation, executes this document expressly warranting that he will comply with: (1) the provision of the contract on providing records, Chapter 8.

7. By submission of this bid, the bidder certifies that it now has and will continue to have the financial capability to fully perform the work required for this contract. Any award of this contract will be made in reliance upon such certification. Upon request therefor, the bidder will submit written verification of such financial capability in a form that is acceptable to the department.

8. In accordance with Section 165 of the State Finance Law, the bidder agrees that tropical hardwoods, as defined in Section 165 of the State Finance Law, shall not be utilized in the performance of this Contract, except as the same are permitted by the foregoing provision of law.

9. The bidder has visited and examined the site of the work and has carefully examined the Contract in the form approved by the Corporation Counsel, and will execute the Contract and perform all its items, covenants and conditions, and will provide, furnish and deliver all the work, materials, supplies, tools and appliances for all labor and materials necessary or required for the hereinafter named work, all in strict conformity with the Contract, for the prices set forth in the Bid Schedule:

10. M/WBE UTILIZATION PLAN: By signing its bid, the bidder agrees to the Vendor Certification and Required Affirmations set forth below, unless a full waiver of the Participation Goals is granted. The Vendor Certification and Required Affirmations will be deemed to satisfy the requirement to complete Section V of Part II of Schedule B: M/WBE Utilization Plan.

Section V: Vendor Certification and Required Affirmations:

I hereby:

1) acknowledge my understanding of the M/WBE participation requirements as set forth in this Contract and the pertinent provisions of Section 6-129 of the Administrative Code of the City of New York and the rules promulgated thereunder;

2) affirm that the information supplied in support of the M/WBE Utilization Plan is true and correct;

3) agree, if awarded this Contract, to comply with the M/WBE participation requirements of this Contract, the pertinent provisions of Section 6-129, and the rules promulgated thereunder, all of which shall be deemed to be material terms of this Contract;

4) agree and affirm that it is a material term of this Contract that the Vendor will award the total dollar value of the M/WBE Participation Goals to certified MBEs and/or WBEs, unless a full waiver is obtained or such goals are modified by the Agency; and

5) agree and affirm, if awarded this Contract, to make all reasonable, good faith efforts to meet the M/WBE Participation Goals, or If a partial waiver is obtained or such goals are modified by the Agency, to meet the modified Participation Goals by soliciting and obtaining the participation of certified MBE and/or WBE firms.

BID FORM

PROJECT ID: CRO-AGS

TOTAL BID PRICE: In the space provided below, the Bidder shall indicate the total bid price in figures.

A. LUMP SUM PRICE - Total price for all labor and material for all required work, excluding items (B), (C) and (D) set forth below. Total Price shall include all costs and expenses, i.e. labor, material overhead and profit for all the Work, described and shown in the drawings and specifications.

Total Price For Labor		Total Price for Material Sold and Delivered		
$ 56,907,104	+	$ 25,866,401	Total Price for Item A=	$ 82,773,505

B. ALLOWANCE for Incidental Asbestos Abatement (Section 028013 of the Specifications) **$15,000.00**

C. AMOUNT for Proprietary Items (pages 2a - 2b) **$443,432.00**

D. AMOUNT for Unit Prices (pages 13a - 13b) $ 1,342,637

TOTAL BID PRICE (Add A + B + C + D) (a/k/a BID PROPOSAL) $ 84,574,604

BB 3/1/18

BIDDER'S SIGNATURE AND AFFIDAVIT

* **SUBCONTRACTOR IDENTIFICATION: You MUST complete and submit the form entitled "Bidder's Identification of Subcontractors" (page 17) at the time you submit your bid. You must submit this form in a separate, sealed envelope (BID ENVELOPE #2). In the event an award of contract is not made to the Bidder, the Bidder hereby authorizes the Agency to shred the form entitled "Bidder's Identification of Subcontractors".** __X__ **Yes** _____ **No**

Bidder: C&L Contracting Corp.

By: Tony Massaro
(Signature of Partner or corporate officer)

Tony Massaro
Attest: Secretary of Corporate Bidder
(Corporate Seal)

Affidavit on the following page should be subscribed and sworn to before a Notary Public

BID FORM

PROJECT ID: CRO-AGS

TOTAL BID PRICE: In the space provided below, the Bidder shall indicate the total bid price in figures.

A. LUMP SUM PRICE - Total price for all labor and material for all required work, excluding items (B), (C) and (D) set forth below. Total Price shall include all costs and expenses, i.e. labor, material overhead and profit for all the Work, described and shown in the drawings and specifications.

Total Price For Labor		Total Price for Material Sold and Delivered		
$ 56,907,104	+	$ 25,866,401	Total Price for Item A= $	82,773,505

B. ALLOWANCE for Incidental Asbestos Abatement (Section 028013 of the Specifications) **$15,000.00**

C. AMOUNT for Proprietary Items (pages 2a - 2b) **$443,432.00**

D. AMOUNT for Unit Prices (pages 13a - 13b) $ 1,342,637

TOTAL BID PRICE (Add A + B + C + D) (a/k/a BID PROPOSAL) $ 84,574,604 -

BB 3/1/18

83,824,574.00

TM

BIDDER'S SIGNATURE AND AFFIDAVIT

* **SUBCONTRACTOR IDENTIFICATION: You MUST complete and submit the form entitled "Bidder's Identification of Subcontractors" (page 17) at the time you submit your bid. You must submit this form in a separate, sealed envelope (BID ENVELOPE #2). In the event an award of contract is not made to the Bidder, the Bidder hereby authorizes the Agency to shred the form entitled "Bidder's Identification of Subcontractors".** X Yes _____ No

Bidder: C&L Contracting Corp.

By: Tony Massaro

(Signature of Partner or corporate officer)

Tony Massaro

Attest: Secretary of Corporate Bidder

(Corporate Seal)

Affidavit on the following page should be subscribed and sworn to before a Notary Public

BID FORM (TO BE NOTARIZED)

****

AFFIDAVIT WHERE BIDDERS IS AN INDIVIDUAL

STATE OF NEW YORK, COUNTY OF _____ ss:

_____ being duly sworn says:

I am the person described in and who executed the foregoing bid, and the several matters therein stated are in all respects true.

_____

(Signature of the person who signed the Bid)

Subscribed and sworn to before me this

____ day of _____, _____

_____

Notary Public

****

AFFIDAVIT WHERE BIDDERS IS A PARTNERSHIP

STATE OF NEW YORK, COUNTY OF _____ ss:

_____ being duly sworn says:

I am a member of _____ the firm described in and which executed the foregoing bid. subscribed the name of the firm thereto on behalf of the firm, and the several matters therein stated are in all respects true.

_____

(Signature of Partner who signed the Bid)

Subscribed and sworn to before me this

____ day of _____, _____

_____

Notary Public

****

AFFIDAVIT WHERE BIDDERS IS A CORPORATION

STATE OF NEW YORK, COUNTY OF Nassau ss:

Tony Massaro being duly sworn says:

I am the Sec./Treas. of the above named corporation whose name is subscribed to and which executed the foregoing bid. I reside at 194 West Shore Drive, Massapequa, NY.

I have knowledge of the several matters therein stated, and they are in all respects true.

_____

(Signature of Corporate Officer who signed the Bid)

Subscribed and sworn to before me this

1 day of March, 2018

_____

Notary Public

JENNIFER M DAVIS
Notary Public, State of New York
No. 01DA6326421
Qualified in Nassau County
Commission Expires June 15, 2017

AFFIRMATION

The undersigned bidder affirms and declares that said bidder is not in arrears to the City of New York upon debt, contract or taxes and is not a defaulter, as surety or otherwise, upon obligation to the City of New York, and has not been declared not responsible, or disqualified, by any agency of the City of New York, nor is there any proceeding pending relating to the responsibility or qualification of the bidder to receive public contracts except

None

(If none, the bidder shall insert the word "None" in the space provided above.)

Full Name of Bidder: C&L Contracting Corp.

Address: 1981 Marcus Ave, Suite E106

City: Lake Success State: New York Zip Code: 11042

CHECK ONE BOX AND INCLUDE APPROPRIATE NUMBER:

☐ A - Individual or Sole Proprietorship *
SOCIAL SECURITY NUMBER

☐ B - Partnership, Joint Venture or other unincorporated organization
EMPLOYER IDENTIFICATION NUMBER

☒ C - Corporation
EMPLOYER IDENTIFICATION NUMBER

11-2790353

By: Tony Massaro
Signature:

Title: Secretary / Treasurer

If a corporation, place seal here

This affirmation must be signed by an officer or duly authorized representative.

* Under the Federal Privacy Act the furnishing of Social Security Numbers by bidders on City contracts is voluntary. Failure to provide a Social Security Number will not result in a bidder's disqualification. Social Security Numbers will be used to identify bidders, proposers or vendors to ensure their compliance with laws, to assist the City in enforcement of laws, as well as to provide the City a means of identifying of businesses which seek City contracts.

BIDDER'S IDENTIFICATION OF SUBCONTRACTORS

NOTICE TO BIDDERS

SUBMISSION: The Bidder must, at the time of the bid, submit the completed form on the next page ("BIDDER'S IDENTIFICATION OF SUBCONTRACTORS"). This form must be submitted in a separate, sealed envelope (BID ENVELOPE #2). Failure to do so will result in the disqualification of the bid as non-responsive.

****

Please be advised that pursuant to GML § 101(5) the Bidder is required to submit with its bid the names of subcontractors it intends to use to perform the following work on this contract, as well as the agreed-upon amount to be paid to each:

- plumbing and gas fitting;
- steam heating, hot water heating, ventilating and air conditioning apparatus; and
- electric wiring and standard illuminating fixtures.

NOTE: This project may not involve all of the above listed subcontractors. Please see the form on the next page which indicates the subcontractors required for this Project.

All listed subcontractors must be used to perform the work identified on this form for the amount listed. The listed subcontractors are not alternatives to each other. The list of subcontractors is to be submiited in a separate sealed envelope by completing the form 'Bidders Identification of Subcontractors' for any subcontractors intended to be used in any of the three trades listed above. If bidder intends to use its own forces for any of the above listed work, bidder should complete this form using its own name.

Failure to submit the completed form on the next page ("Bidder's Identification of Subcontractors") that includes the names of subcontractors and the agreed upon amounts to be paid to such subcontractors will render the bid non-responsive.

PLEASE NOTE: for any contract that is subject to M/WBE Participation Goals under Local Law 129, if the bidder's intention to use its own forces to do any of the above-referenced work would result in Bidder's failure to attain the Target Subcontracting Percentage identified in Schedule B (Subcontractor Utilization Plaan), the bid will be non-responsive unless the bidder requests and obtains a Waiver of Target Subcontracting Percentage (Schedule B, Part III) in advance of bid submission. Failure to submit the completed 'BIDDERS IDENTIFICATION OF SUBCONTRACTORS' form that includes the names of subcontractors and the agreed upon amounts to be paid to such subcontractors will render the bid non-responsive.

After the low bid is announced, the sealed list submitted by the low bidder will be opened and the names of the subcontractors will be announced. The sealed lists of subcontractors submitted by all other bidders shall be maintained by the Agency unopened unless such bidder shall become the low bidder (e.g., the initial low bidder is found non-responsive). All unopened lists of subcontractors shall be returned to the bidders unopened after contract award, unless the bidder has given the agency permission to shred the form.

After bid submission, any change of subcontractor or agreed-upon amount to be paid to each shall require approval of the Agency upon a showing of a legitimate construction need which shall include, but not be limited to, a change in project specifications, a change in project material costs, a change to subcontractor status as determined pursuant to §222 (2)(e) of the Labor Law, or if the subcontractor has become otherwise unwilling, unable or unavailable to perform the subcontract.

BIDDER'S IDENTIFICATION OF SUBCONTRACTORS

Project ID: CRO-AGS

SUBMISSION: In addition to its Bid (Bid Envelope # 1), the Bidder must, at the time of the bid, complete and submit this form in a separate, sealed envelope (Bid Envelope # 2). To complete this form, the Bidder must identify the subcontractors it intends to use for the work listed below, as well as the dollar amount to be paid to each subcontractor. Failure to complete this form and submit it in a separate, sealed envelope will result in the disqualification of the bid as non-responsive.

The Bidder intends to use the following subcontractors. If the Bidder intends to do any of the work referenced below with its own forces, the Bidder should complete this form using its own name. If multiple subcontractors for any trade are proposed, Bidder may submit multiple copies of this form.

1. **PLUMBING CONTRACTOR:**

_____
(Print Name)

Agreed amont to be paid Subcontractor: $ _____

Description of Plumbing Work:

_____

_____

_____

2. **HVAC CONTRACTOR:**

_____
(Print Name)

Agreed amont to be paid Subcontractor: $ _____

Description of HVAC Work:

_____

_____

_____

3. **ELECTRICAL CONTRACTOR:**

_____
(Print Name)

Agreed amont to be paid Subcontractor: $ _____

Description of Electrical Work:

_____

_____

_____

BIDDER'S SIGNATURE: The Bidder must sign and complete this form in the spaces provided below:

_____
(Bidder's Signature) (Print Name)

_____
(Address)

_____
(Title) (Phone #) (Fax#) (Date)

BIDDER'S IDENTIFICATION OF SUBCONTRACTORS

Project ID: CRO-AGS

SUBMISSION: In addition to its Bid (Bid Envelope # 1), the Bidder must, at the time of the bid, complete and submit this form in a separate, sealed envelope (Bid Envelope # 2). To complete this form, the Bidder must identify the subcontractors it intends to use for the work listed below, as well as the dollar amount to be paid to each subcontractor. Failure to complete this form and submit it in a separate, sealed envelope will result in the disqualification of the bid as non-responsive.

The Bidder intends to use the following subcontractors. If the Bidder intends to do any of the work referenced below with its own forces, the Bidder should complete this form using its own name. If multiple subcontractors for any trade are proposed, Bidder may submit multiple copies of this form.

1. **PLUMBING CONTRACTOR:** EASTERN PLUMBING & MECHANICAL (Print Name)
   Agreed amont to be paid Subcontractor: $ 2,116,500-
   Description of Plumbing Work: Division 22

2. **HVAC CONTRACTOR:** CDE AIR CONDITIONING (Print Name)
   Agreed amont to be paid Subcontractor: $ 2,191,821-
   Description of HVAC Work: Division 23

3. **ELECTRICAL CONTRACTOR:** UPTOWN ELECTRIC (Print Name)
   Agreed amont to be paid Subcontractor: $ 3,009,000-
   Description of Electrical Work: Division 26

BIDDER'S SIGNATURE: The Bidder must sign and complete this form in the spaces provided below:

(Bidder's Signature) Tony Massaro - C&L Contracting Corp. (Print Name)

1981 Marcus Ave, E106, Lake Success, 11042
(Address)

Secretary / Treasurer	516.326.4460	516.326.4480	01 March 2108
(Title)	(Phone #)	(Fax#)	(Date)

BID BOND I
FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS. That we, C & L Contracting Corp.
1981 Marcus Avenue, Suite E106, Lake Success, NY 11042

hereinafter referred to as the "Principal", and Arch Insurance Company
3 Parkway, Suite 1500
Philadelphia, PA 19102

hereinafter referred to as the "Surety" are held and firmly bound to THE CITY OF NEW YORK, hereinafter referred to as the "CITY", or to its successors and assigns in the penal sum of

Ten Percent of Amount Bid

($ 10%), Dollars lawful money of the United States, for the payment of which said sum of money well and truly to be made, we, and each of us, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Whereas, the Principal is about to submit (or has submitted) to the City the accompanying proposal, hereby made a part hereof, to enter into a contract in writing for

Croton Water Treatment Plant Facilities & Landscape Construction; FMS# CRO-AGS, Bronx, NY (Mosholu Golf Course/Van Cortland Park)

NOW, THEREFORE, the conditions of this obligation are such that if the Principal shall not withdraw said Proposal without the consent of the City for a period of forty-five (45) days after the opening of bids and in the event of acceptance of the Principal's Proposal by the City, if the Principal shall:

(a) Within ten (10) days after notification by the City, execute in quadruplicate and deliver to the City all the executed counterparts of the Contract in the form set forth in the Contract Documents, in accordance with the proposal as accepted, and

(b) Furnish a performance bond and separate payment bond, as may be required by the City, for the faithful performance and proper fulfillment of such Contract, which bonds shall be satisfactory in all respects to the City and shall be executed by good and sufficient sureties, and

(c) In all respects perform the agreement created by the acceptance of said Proposal as provided in the Information for Bidders, bound herewith and made a part hereof, or if the City shall reject the aforesaid Proposal, then this obligation shall be null and void; otherwise to remain in full force and effect.

BID BOND 2

In the event that the Proposal of the Principal shall be accepted and the Contract be awarded to him the Surety hereunder agrees subject only to the payment by the Principal of the premium therefore, if requested by the City, to write the aforementioned performance and payment bonds in the form set forth in the Contract Documents.

It is expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

There shall be no liability under this bond if, in the event of the acceptance of the Principal's Proposal by the City, either a performance bond or payment bond, or both, shall not be required by the City on or before the 30th day after the date on which the City signs the Contract.

The surety, for the value received, hereby stipulates and agrees that the obligations of the Surety and its bond shall in no way be impaired or affected by any postponements of the date upon which the City will receive or open bids, or by any extensions of the time within which the City may accept the Principal's Proposal, or by any waiver by the City of any of the requirements of the Information for Bidders, and the Surety hereby waives notice of any such postponements, extensions, or waivers.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers the 13th day of February, 2018.

(Seal)

C & L Contracting Corp. (L.S.)
Principal

By: _____

(Seal)

Arch Insurance Company
Surety

By: Marion R. Vail
Marion R. Vail, Attorney-in-Fact

BID BOND 3

ACKNOWLEDGMENT OF PRINCIPAL, IF A CORPORATION

State of New York County of Nassau ss:
On this 1 day of March, 2018, before me personally came
Tony Massaro to me known, who, being by me duly sworn, did depose and say
that he resides at 194 West Shore Drive, Massapequa NY 11758
that he is the Sec/Tres of C & L Contracting Corp.
the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation; that one of the seals affixed to said instrument is such seal; that it was so affixed by order of the directors of said corporation, and that he signed his name thereto by like order.

JENNIFER M DAVIS
Notary Public, State of New York
No. 01DA6326421
Qualified in Nassau County
Commission Expires June 15, 2019

Notary Public

ACKNOWLEDGMENT OF PRINCIPAL, IF A PARTNERSHIP

State of _____ County of _____ ss:
On this _____ day of _____, _____, before me personally appeared
_____ to me known and known to me to be one of the members of the
firm of _____ described in and who executed the foregoing instrument, and he acknowledged to me that he executed the same as and for the act and deed of said firm.

_____
Notary Public

ACKNOWLEDGMENT OF PRINCIPAL, IF AN INDIVIDUAL

State of _____ County of _____ ss:
On this _____ day of _____, _____, before me personally appeared
_____ to me known and known to me to be the person described in and who executed the foregoing instrument and acknowledged that he executed the same.

_____
Notary Public

ACKNOWLEDGMENTS AND JUSTIFICATION OF SURETIES

Surety Acknowledgement

State of Connecticut

County of Hartford

On this 13th day of February, 2018 before me personally appeared

Marion R. Vail

To me know, who being by me duly sworn did depose and say that he/she is the

Attorney-in-Fact of

Arch Insurance Company

The Corporation described in and which executed the above instrument; that he/she knows the seal of said Corporation and that he/she signed his/her name thereto by like order.

Notary Public: Victoria P. Parkerson

My Commission Expires: February 28, 2018

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Note, Loan, Letter of Credit, Currency Rate, Interest Rate or Residential Value Guarantees.

POWER OF ATTORNEY

Know All Persons By These Presents:

That the Arch Insurance Company, a corporation organized and existing under the laws of the State of Missouri, having its principal administrative office in Jersey City, New Jersey (hereinafter referred to as the "Company") does hereby appoint:

Marion R. Vail

its true and lawful Attorney-in-Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed:

Any and all bonds, undertakings, recognizances and other surety obligations.

Surety Bond Number: Bid Bond

Principal: C & L Contracting Corp.

Obligee: City of New York, Dept. of Design & Construction

This authority does not permit the same obligation to be split into two or more bonds in order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognizances and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in Jersey City, New Jersey.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on September 15, 2011, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:

"VOTED, That the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact, and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds, undertakings, recognizances and other surety obligations obligatory in the nature thereof, and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on September 15, 2011:

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on September 15, 2011, and any such power so executed, sealed and certified with respect to any bond or undertaking to which it is attached, shall continue to be valid and binding upon the Company.

In Testimony Whereof, the Company has caused this instrument to be signed and its corporate seal to be affixed by their authorized officers, this _____ day of _____, 20____.

Attested and Certified

Arch Insurance Company

Patrick K. Nails, Secretary

David M. Finkelstein, Executive Vice President

STATE OF PENNSYLVANIA SS

COUNTY OF PHILADELPHIA SS

I, Michele Tripodi, a Notary Public, do hereby certify that Patrick K. Nails and David M. Finkelstein personally known to me to be the same persons whose names are respectively as Secretary and Executive Vice President of the Arch Insurance Company, a Corporation organized and existing under the laws of the State of Missouri, subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that they being thereunto duly authorized signed, sealed with the corporate seal and delivered the said instrument as the free and voluntary act of said corporation and as their own free and voluntary acts for the uses and purposes therein set forth.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MICHELE TRIPODI, Notary Public
City of Philadelphia, Phila. County
My Commission Expires July 31, 2021

Michele Tripodi, Notary Public
My commission expires 07/31/2021

CERTIFICATION

I, Patrick K. Nails , Secretary of the Arch Insurance Company, do hereby certify that the attached Power of Attorney dated _____ on behalf of the person(s) as listed above is a true and correct copy and that the same has been in full force and effect since the date thereof and is in full force and effect on the date of this certificate; and I do further certify that the said David M. Finkelstein, who executed the Power of Attorney as Executive Vice President, was on the date of execution of the attached Power of Attorney the duly elected Executive Vice President of the Arch Insurance Company.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the Arch Insurance Company on this 13th day of FEB., 2018.

Patrick K. Nails, Secretary

This Power of Attorney limits the acts of those named therein to the bonds and undertakings specifically named therein and they have no authority to bind the Company except in the manner and to the extent herein stated.

PLEASE SEND ALL CLAIM INQUIRIES R.ELATING TO THIS BOND TO THE FOLLOWING ADDRESS:

Arch Insurance – Surety Division
3 Parkway, Suite 1500
Philadelphia, PA 19102

ARCH INSURANCE COMPANY
STATEMENT OF FINANCIAL CONDITION
DECEMBER 31, 2016

Assets

Cash in Banks	$ 122,650,516
Bonds owned	$ 2,450,536,661
Stocks	$ 453,733,442
Premiums in course of collection	$ 350,778,901
Accrued interest and other assets	$ 351,607,098
Total Assets	$ 3,729,306,618

Liabilities

Reserve for losses and adjustment expenses	$ 1,596,882,042
Reserve for unearned premiums	$ 357,453,868
Ceded reinsurance premiums payable	$ 153,810,291
Amounts withheld or retained by company for account of others	$ 310,027,951
Reserve for taxes, expenses and other liabilities	$ 422,529,971
Total Liabilities	2,840,704,123
Surplus as regards policyholders	888,602,495
Total Surplus and Liabilities	$ 3,729,306,618

By: _____ Attest: _____
Senior Vice President, Chief Financial Officer and Treasurer
Senior Vice President, General Counsel and Secretary

State of New Jersey)
) SS
County of Hudson)

Thomas James Ahern, Senior Vice President, Chief Financial Officer and Treasurer and Patrick Kenneth Nails, Senior Vice President, General Counsel and Secretary being duly sworn, of ARCH INSURANCE COMPANY, Missouri; and that the foregoing is a true and correct statement of financial condition of said company, as of December 31, 2016.

Subscribed and sworn to before me, this 2ND day of March, 2017

Notary Public Mary E. Keating

MARY E. KEATING
NOTARY PUBLIC OF NEW JERSEY
ID # 2449626
My Commission Expires 8/28/2019

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CONTRACT 1 - GENERAL CONSTRUCTION

	Description of Work	Quantity	Unit	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total Cost Material + Labor
01 0000	**GENERAL REQUIREMENTS**							
01 3010	**LEED Certification Requirements**							
	Mobilization	1	LS	$ 150,000.00	$ 150,000.00	$ 150,000.00	$ 150,000.00	$ 300,000.00
	Temporary Heat	1	LS	$ 13,212.00	$ 13,212.00	$ 30,828.00	$ 30,828.00	$ 44,040.00
	Security Guards / Site Security	1	LS	$ 233,208.00	$ 233,208.00	$ 544,151.00	$ 544,151.00	$ 777,359.00
	General Conditions	1	LS	$ 2,113,817.00	$ 2,113,817.00	$ 4,932,241.00	$ 4,932,241.00	$ 7,046,058.00
	Closeout	1	LS	$ 22,020.00	$ 22,020.00	$ 51,380.00	$ 51,380.00	$ 73,400.00
	Bonds	1	LS	$ 751,694.00	$ 751,694.00	$ -	$ -	$ 751,694.00
	Insurances	1	LS	$ 110,100.00	$ 110,100.00	$ 256,900.00	$ 256,900.00	$ 367,000.00
	Subtotal				**$ 3,394,051.00**		**$ 5,965,500.00**	**$ 9,359,551.00**
00 0002	**Quality Assurance Reference Mockups (included w/ section 013010)**							
02 0000	**EXISTING CONDITIONS**							
02 4000	**Demolition of Existing Structures**							
	Cap and abandon exisiting utility service	15	EA	$ -	$ -	$ 1,023.20	$ 15,348.00	$ 15,348.00
	Demolish and remove exisiting utility service	7,200	LF	$ -	$ -	$ 43.81	$ 315,450.00	$ 315,450.00
	Remove Exisiting Asphalt Pavement	2,400	SF	$ -	$ -	$ 23.37	$ 56,089.00	$ 56,089.00
	Remove exisiting fence	400	LF	$ -	$ -	$ 26.98	$ 10,790.00	$ 10,790.00
	Relocate 10' jersey barrier fence	866	LF	$ -	$ -	$ 131.53	$ 113,905.00	$ 113,905.00
	Sawcut Pavement	32	LF	$ -	$ -	$ 18.34	$ 587.00	$ 587.00
	8'0' ht ex chain link fence to remain protect and end post, replace if damaged	1	LS	$ -	$ -	$ 14,680.00	$ 14,680.00	$ 14,680.00
	Remove Existing Asphalt Pavement	Included as Shown			$ -		$ -	$ -
	Remove Existng Pavement w/ Hand Excavation Around Tress	Included as Shown			$ -		$ -	$ -
	Remove Existing Plaza	Included as Shown			$ -		$ -	$ -
	Demolish & Remove Portion of Exisiting Pavement	Included as Shown			$ -		$ -	$ -
	Remove Chain Link Fence	765	LF	$ 0.86	$ 661.00	$ 2.01	$ 1,541.00	$ 2,202.00
	Sawcut Pavement	Included as Shown			$ -		$ -	$ -
	Cap & Abandon Existing Utility Service	Included as Shown			$ -		$ -	$ -
	Demolish & Remove Exisitng Structure	Included as Shown			$ -		$ -	$ -
	Relocate Jersey Barrier/Fence (10'0"H)	Included as Shown			$ -		$ -	$ -
	Remove & Dispose off Site Jersey Barrier Fence (10"-0"H)	1,640	LF	$ 22.02	$ 36,113.00	$ 51.38	$ 84,263.00	$ 120,376.00
	Demolish & Remove Exisiting Utility Service	Included as Shown			$ -		$ -	$ -
	Demolish & Remove Exisitng Ornamental Wall:	1,000	cy	$ -	$ -	$ 435.73	$ 435,729.00	$ 435,729.00
	Wall & Columns (Above Grade)	Included as Shown			$ -		$ -	$ -
	Wall & Columns (Below Grade)	Included as Shown			$ -		$ -	$ -
	Excavation & Backfill below grade after demolishing ornamental wall							
	Demolish & Remove Existing North/South Waterfall Feature Wall	700	cy	$ -	$ -	$ 377.32	$ 264,123.00	$ 264,123.00
	Cascade Walls (Above Grade)	Included as Shown			$ -		$ -	$ -
	Cascade Walls (Below Grade)	Included as Shown			$ -		$ -	$ -
	Granite Paving, Stone Pavers	Included as Shown			$ -		$ -	$ -

Project: Croton Water Treatment Plant Facilities and Landscape Construction DDC ID: CRO-AGS
Location: 3651 Jerome Avenue, Bronx NY 10467 Sponsor Agency: NYC Dept of Environmental Protection
Bidder: C & L Contracting Corp.

CSI #	DESCRIPTION OF WORK	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST (MATERIAL & LABOR)
	Subtotal				**$ 36,774.00**		**$ 1,312,505.00**	**$ 1,349,279.00**
03 0000	**CONCRETE**							
03 3000	**Cast-in-Place Concrete**							
	Building:							
	Structural concrete, in place column footing, includes forms (4 uses), reinforcing steel, and finishing	1,625	CY	$ 132.12	$ 214,695.00	$ 308.28	$ 500,955.00	$ 715,650.00
	Concrete Plinth at canopy	36	EA	$ 15,854.39	$ 570,758.00	$ 10,569.61	$ 380,506.00	$ 951,264.00
	Misc concrete	1	LS	$ 932,006.00	$ 932,006.00	$ 2,174,680.00	$ 2,174,680.00	$ 3,106,686.00
	Concrete in Place, Slab on Grade w/ rebar and formwork -6" th	8,100	SF	$ 6.59	$ 53,362.00	$ 15.37	$ 124,513.00	$ 177,875.00
	Concrete in Place, 6" (concrete plank)	Included as Shown			$ -		$ -	$ -
	Structural concrete, in place, retaining wall, level backfill, includes forms (4 uses), reinforcing steel, and finishing	Included as Shown			$ -		$ -	$ -
	Cast in Place Pilasters 36x36 8' tall	Included as Shown			$ -		$ -	$ -
	Cast in Place structural columns 12x36 26' tall	20	CY	$ 2,987.10	$ 59,742.00	$ 6,969.85	$ 139,397.00	$ 199,139.00
	Structual concrete, in place, retaining wall footing, includes forms(4 uses), reinforcing steel, and finishing	Included as Shown			$ -		$ -	$ -
	Structural concrete, in place, stairs, cast on ground, steps - exterior #6 PRECAST	32	trds	$ 2,069.88	$ 66,236.00	$ 4,829.72	$ 154,551.00	$ 220,787.00
	Structural concrete, in place, stairs, ladning - exterior #6	Included as Shown			$ -		$ -	$ -
	Concrete bridge on pile foundation at end of tee box	NIC						$ -
	Structural concrete, in place column footing, includes forms (4 uses), reinforcing steel, and finishing	Included as Shown			$ -		$ -	$ -
	Concrete in Place, Slab on Grade w/ rebar and formwork -6" th	34,100	SF	$ 20.80	$ 709,213.00	$ 48.53	$ 1,654,832.00	$ 2,364,045.00
	Concrete in Place, Slab on Grade w/ rebar and formwork - 12" th	Included Above			$ -		$ -	$ -
	Concrete in Place, fill metal deck - 7 1/2"	6,184	SF	$ -	$ -	$ -	$ -	$ -
	Concrete in Place, concrete planks		SF	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Concrete in Place, parapet roof (PRECAST)	390	lf	$ 178.98	$ 69,803.00	$ 417.63	$ 162,875.00	$ 232,678.00
	Structural concrete, in place, stairs, cast on ground, steps - interior #2 (PRECAST) ,#3 (CIP)	47	LF	$ 1,291.21	$ 60,687.00	$ 3,012.83	$ 141,603.00	$ 202,290.00
	Structural concrete, in place, stairs, cast on ground, steps - exterior #4	NIC			$ -		$ -	$ -
	Structural concrete, in place, retaining wall, level backfill, includes forms (4 uses), reinforcing steel, and finishing	Included Above			$ -		$ -	$ -
	Structural concrete, in place, retaining wall footing, includes forms (4 uses), reinforcing steel, and finishing	Included Above			$ -		$ -	$ -
	Structural concrete, in place, stairs, cast on ground, steps - exterior #5	20	LF	$ 1,145.05	$ 22,901.00	$ 2,671.75	$ 53,435.00	$ 76,336.00
	Structural concrete, in place, stair landing, cast on ground, includes forms	Included as Shown			$ -		$ -	$ -
	Cast in Place structural columns 14" 20' tall	20	CY	$ -	$ -	$ -	$ -	$ -
	Cast in Place structural columns 14" 10' tall	Included as Shown			$ -		$ -	$ -
	Grout, non-shrink, for column and machine bases, non-metallic at columns	17	EA	$ 155.41	$ 2,642.00	$ 362.71	$ 6,166.00	$ 8,808.00
	Concrete sealer at exposed ceiling	8,220	SF	$ 0.79	$ 6,518.00	$ 1.85	$ 15,208.00	$ 21,726.00
	Site:							
	Concrete Footing for netting poles @ cart path fence	18	EA	$ 3,676.72	$ 66,181.00	$ 8,579.06	$ 154,423.00	$ 220,604.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction DDC ID: CRO-AGS
Location: 3651 Jerome Avenue, Bronx NY 10467 Sponsor Agency: NYC Dept of Environmental Protection
Bidder: C & L Contracting Corp.

CSI #	DESCRIPTION OF WORK	QUANTITY	UNITS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
	Concrete Footing for Weathing Steel Overspill	27	CY	$ 457.85	$ 12,362.00	$ 1,068.37	$ 28,846.00	$ 41,208.00
	Concrete Footing for Weir Wall A	62	CY	$ 726.66	$ 45,053.00	$ 1,695.53	$ 105,123.00	$ 150,176.00
	Concrete Footing for Weir Wall B	58	CY	$ 726.66	$ 42,146.00	$ 1,695.55	$ 98,342.00	$ 140,488.00
	Concrete Footing for Weir Wall C	52	CY	$ 726.65	$ 37,786.00	$ 1,695.54	$ 88,168.00	$ 125,954.00
	Concrete Footing for Weir Wall D	29	CY	$ 726.66	$ 21,073.00	$ 1,695.55	$ 49,171.00	$ 70,244.00
	Concrete Footing for Weir Wall E	10	CY	$ 726.70	$ 7,267.00	$ 1,695.50	$ 16,955.00	$ 24,222.00
	Concrete Footing for Weir Wall F	7	CY	$ 726.57	$ 5,086.00	$ 1,695.57	$ 11,869.00	$ 16,955.00
	Concrete Weir Wall A	Included as Shown			$ -		$ -	$ -
	Concrete Weir Wall B	Included as Shown			$ -		$ -	$ -
	Concrete Weir Wall C	Included as Shown			$ -		$ -	$ -
	Concrete Weir Wall D	Included as Shown			$ -		$ -	$ -
	Concrete Weir Wall E	Included as Shown			$ -		$ -	$ -
	Concrete Weir Wall F	Included as Shown			$ -		$ -	$ -
	Concrete Footing for Precast Seatl Wall	52	CY	$ 855.46	$ 44,484.00	$ 1,996.08	$ 103,796.00	$ 148,280.00
	Pigmented Concrete Paving	Included as Shown			$ -		$ -	$ -
	Structural concrete, in place, retaining wall, level backfill, includes forms(4uses), reinforcing steel, and finishing	Included as Shown			$ -		$ -	$ -
	Structural concrete, in place, retaining wall footing, includes forms (4 uses), reinforcing steel, and finishing	Included as Shown			$ -		$ -	$ -
	Concrete Footing for Weird Wall G	52	CY	$ 968.88	$ 50,382.00	$ 2,260.71	$ 117,557.00	$ 167,939.00
	Concrete Weir Wall G	Included as Shown			$ -		$ -	$ -
	Misc. Concrete							
	Concrete Footing for Precast Seat Wall	see above			$ -		$ -	$ -
	Pigmented Concrete Paving	see above			$ -		$ -	$ -
	Structural concrete, in place, retaining wall, level backfill, includes forms(4uses), reinforcing steel, and finishing	see above			$ -		$ -	$ -
	Structural concrete, in place, retaining wall footing, includes forms(4 uses), reinforcing steel, and finishing	see above			$ -		$ -	$ -
	Concrete Footing for Weir Wall G	see above			$ -		$ -	$ -
	Concrete Weir Wall G	see above			$ -		$ -	$ -
	Misc. Concrete	see above			$ -		$ -	$ -
	Subtotal				**$ 3,100,383.00**		**$ 6,282,971.00**	**$ 9,383,354.00**
03 3519	**Polished Concrete Floor Finishing**							
	Building:							
	Concrete floor coating	3,084	SF	$ 3.11	$ 9,580.00	$ 7.25	$ 22,355.00	$ 31,935.00
	Site:							
	Precast Pigmented Seat Wall				$ -		$ -	$ -
	Subtotal				**$ 9,580.00**		**$ 22,355.00**	**$ 31,935.00**
03 4100	**Precast Structural Concrete**							
	Precast Structural Concrete	2,061	SF	$ 280.83	$ 578,786.00	$ 655.27	$ 1,350,502.00	$ 1,929,288.00
	Precast structural columns 10x36 18' tall	41	EA	$ 1,792.32	$ 73,485.00	$ 4,182.07	$ 171,465.00	$ 244,950.00
	Fabricated bridge, precast concrete, complete in place, 11'6" wide, includes erection	350	SF	$ 27.43	$ 9,601.00	$ 64.00	$ 22,401.00	$ 32,002.00
	Precast Concrete slab, long pieces, span to 10', 8" thick	16,462	SF	$ 19.46	$ 320,329.00	$ 45.40	$ 747,435.00	$ 1,067,764.00
	Subtotal				**$ 982,201.00**		**$ 2,291,803.00**	**$ 3,274,004.00**

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
03 4500	**Architectural Pre-Cast Concrete**							
	Building:							
	Precast Concrete slab, walkway 10" th.	80	SF	$ 88.08	$ 7,046.00	$ 205.53	$ 16,442.00	$ 23,488.00
	Site:							
	Precast Pigmented Seat Wall	200	LF	$ 154.14	$ 30,828.00	$ 359.66	$ 71,932.00	$ 102,760.00
	Subtotal				**$ 37,874.00**		**$ 88,374.00**	**$ 126,248.00**
03 4900	**Glass Fiber Reinforced Concrete (GFRC) Panels**							
	Eave/Soffit, GFRC	12,420	SF	$ 21.09	$ 261,929.00	$ 49.21	$ 611,167.00	$ 873,096.00
	Eave/Soffit, GFRC at stair #1	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 261,929.00**		**$ 611,167.00**	**$ 873,096.00**
03 5300	**Concrete Topping**							
	5" thick concrete topping	14,830	SF	$ 6.85	$ 101,640.00	$ 15.99	$ 237,160.00	$ 338,800.00
	Subtotal				**$ 101,640.00**		**$ 237,160.00**	**$ 338,800.00**
04 0000	**MASONRY**							
04 2000	**Unit Masonry (included w/ other Division 4 sections)**							
04 4010	**Gabion Site Walls**							
	Stone check dam w/ geo textile (Refer E/C500) - 10'0"Lx4'-0"W weir	53	EA	$ 220.21	$ 11,671.00	$ 513.79	$ 27,231.00	$ 38,902.00
	Gabion Site Wall 38	5,464	CY	$ 68.69	$ 375,330.00	$ 160.28	$ 875,770.00	$ 1,251,100.00
	Gabion Site Wall 16 (Premium for hand placement)	Included as Shown			$ -		$ -	$ -
	Gabion Site Wall 16 (subbase)	Included as Shown			$ -		$ -	$ -
	Gabion Site Wall 16	Included as Shown			$ -		$ -	$ -
	Gabion Site Wall 16 (Premium for hand placement)	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 387,001.00**		**$ 903,001.00**	**$ 1,290,002.00**
04 4020	**Exterior Stone Rockery**							
	Boulders 30" to 42"	840	EA	$ 1,577.13	$ 1,324,787.00	$ 1,290.38	$ 1,083,916.00	$ 2,408,703.00
	Type 1 Boulders	Included as Shown			$ -		$ -	$ -
	Type 2 Boulders	Included as Shown			$ -		$ -	$ -
	Type 3 Boulders	Included as Shown			$ -		$ -	$ -
	Type 4 Boulders	Included as Shown			$ -		$ -	$ -
	Type 5 Boulders	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 1,324,787.00**		**$ 1,083,916.00**	**$ 2,408,703.00**
04 4200	**Exterior Stone Cladding**							
	Ashlar veneer, random or random rectangular, seam face, split joints, 4 - 1/2" th. ST-03	19,272	SF	$ 30.69	$ 591,497.00	$ 71.61	$ 1,380,159.00	$ 1,971,656.00
	Ashlar veneer, random or random rectangular, split or rock face, split joints, 4 - 1/2" th ST-09	Included as Shown			$ -		$ -	$ -
	Stone coping ST 10	Included as Shown			$ -		$ -	$ -

Project: Croton Water Treatment Plant Facilities and Landscape Construction DDC ID: CRO-AGS
Location: 3651 Jerome Avenue, Bronx NY 10467 Sponsor Agency: NYC Dept of Environmental Protection
Bidder: C & L Contracting Corp.

CSI	DESCRIPTION OF WORK	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	Ashlar veneer, random or random rectangular, seam face, split joints, 4 1/2" th. ST-03	Included as Shown			$ -		$ -	$ -
	Stone cladding @ doors	Included as Shown			$ -		$ -	$ -
	Ashlar veneer, random or random rectangular, split or rock face, split joints, 4-1/2" th ST-09	Included as Shown			$ -		$ -	$ -
	Ashlar veneer, random or random rectangular, split or rock face, split joints, 4-1/2" th ST-05	Included as Shown			$ -		$ -	$ -
	Stone coping	800	lf	$ 39.16	$ 31,327.00	$ 91.37	$ 73,098.00	$ 104,425.00
	Bluestone paving, smooth finish	NIC			$ -		$ -	$ -
	Bluestone wall base	NIC			$ -		$ -	$ -
	Subtotal				**$ 622,824.00**		**$ 1,453,257.00**	**$ 2,076,081.00**
05 0000	**METALS**							
05 1200	**Structural Steel Framing**							
	Structural steel member, beams	146,800	LBS	$ 4.53	$ 664,595.00	$ 10.56	$ 1,550,721.00	$ 2,215,316.00
	Structural steel member, custom columns	6	EA	$ 2,055.17	$ 12,331.00	$ 4,795.50	$ 28,773.00	$ 41,104.00
	Shear studs	2,274	EA	$ 3.52	$ 8,012.00	$ 8.22	$ 18,694.00	$ 26,706.00
	Moment connections	58	EA	$ 44.79	$ 2,598.00	$ 104.53	$ 6,063.00	$ 8,661.00
	Pin Joints	6	EA	$ 73.33	$ 440.00	$ 171.33	$ 1,028.00	$ 1,468.00
	Structural steel member HSS 4x4 3/8" stringers	Included as Shown			$ -		$ -	$ -
	Structural steel member - support steel	Included as Shown			$ -		$ -	$ -
	(Premium for curving the stair)	Included as Shown			$ -		$ -	$ -
	Wire rope turnbuckle, jaw & jaw, 1/2"x6"	Included as Shown			$ -		$ -	$ -
	Steel wire rope, bright, IPS, IWRC, 6x19, 500' roll x 1/4" dia	Included as Shown			$ -		$ -	$ -
	Stair, shop fabricated, steel, 4'-0" W, incl pipe railing, stringers, case iron treads w/ safety nosing, perrise - stair #1	1	LS	$ 70,402.00	$ 70,402.00	$ 164,272.00	$ 164,272.00	$ 234,674.00
	Landing, shop fabricated, steel, incl pipe railing, stringers, cast iron treads w/ safety nosing, per riser	Included as Shown			$ -		$ -	$ -
	Structural steel for Catwalk	21,900	LBS	$ 3.84	$ 84,103.00	$ 8.96	$ 196,242.00	$ 280,345.00
	Subtotal				**$ 842,481.00**		**$ 1,965,793.00**	**$ 2,808,274.00**
05 1213	**Architecturally Exposed Structural Steel (AESS)**							
	Architecturally Exposed Structural Steel (AESS)	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ -**		**$ -**	**$ -**
05 1250	**Netting Barrier System**							
	Netting Barrier 24'ht	1	ls	$ 58,720.00	$ 58,720.00	$ 234,880.00	$ 234,880.00	$ 293,600.00
	Painted Steel netting pole arm (AESS)	18	ea	$ 15,414.00	$ 277,452.00	$ 35,966.00	$ 647,388.00	$ 924,840.00
	Subtotal				**$ 336,172.00**		**$ 882,268.00**	**$ 1,218,440.00**
05 3100	**Steel Deck**							
	Composite metal deck, 1 1/2", 18 ga.	18,037	SF	$ 3.45	$ 62,317.00	$ 8.06	$ 145,405.00	$ 207,722.00
	Subtotal				**$ 62,317.00**		**$ 145,405.00**	**$ 207,722.00**
05 4000	**Cold Formed Metal Framing (included w/ section 034900)**							

	DESCRIPTION OF WORK	QNTY	UNITS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
05 5000	**Miscellaneous Metals**							
	Building:							
	Miscellaneous Metals	28,000	GSF	$ 17.20	$ 481,721.00	$ 40.14	$ 1,124,017.00	$ 1,605,738.00
	Steel Grating - FT 02	470	SF	$ -	$ -	$ -	$ -	$ -
	Roof support	1	LS	$ -	$ -	$ -	$ -	$ -
	Grating at Catwalk	2,312	SF	$ 35.25	$ 81,492.00	$ 82.24	$ 190,147.00	$ 271,639.00
	Site:							
	Steel Edges at Asphalt Paving	Included as Shown			$ -		$ -	$ -
	Aluminum edging	1,862	LF	$ 10.57	$ 19,686.00	$ 24.67	$ 45,934.00	$ 65,620.00
	Subtotal				**$ 582,899.00**		**$ 1,360,098.00**	**$ 1,942,997.00**
05 5020	**Weathering Steel**							
	1" Weathering Steel at Spillway w/ spillway	25	lf	$ 493.24	$ 12,331.00	$ 1,150.92	$ 28,773.00	$ 41,104.00
	Subtotal				**$ 12,331.00**		**$ 28,773.00**	**$ 41,104.00**
05 5210	**Steel Pipe and Tube Railings**							
	Building:	1	ls	$ 1,214,269.00	$ 1,214,269.00	$ 2,833,293.00	$ 2,833,293.00	$ 4,047,562.00
	Railing, pipe, steel, wall rail, galvanized, 1-1/4" dia, shop fabricated - @ ramp	Included as Shown			$ -		$ -	$ -
	Hand rail - Type GR-01 E at Stair#6	Included as Shown			$ -		$ -	$ -
	Hand rail - Type GR-01 EE at Stair#6	Included as Shown			$ -		$ -	$ -
	Guard rail - Type GR-01 A at Rooftop	Included as Shown			$ -		$ -	$ -
	Guard rail - Type GR-01 B at Rooftop	Included as Shown			$ -		$ -	$ -
	Guard rail - Type GR-01 CC at Parapet A128	Included as Shown			$ -		$ -	$ -
	Railing, pipe, stainless steel, #4 finish, 1 rail, 3'-6" high, posts @ 5' O.C., 1-1/4" dia, shop fabricated # 5	Included as Shown			$ -		$ -	$ -
	Floor mounted guard rail at golf ball collection room	Included as Shown			$ -		$ -	$ -
	Guard rail - Typr GR-01C at Stair #1	Included as Shown			$ -		$ -	$ -
	Railing, pipe, steel, galvanized, 8 rails, 3'-6" high, posts @ 5' O.C., 1-1/2" dia, shop fabricated #2	Included as Shown			$ -		$ -	$ -
	Railing, pipe, stainless steel, #4 finish, 1 rail, 3'-6" high, posts @ 5' O.C., 1-1/4" dia, shop fabricated #3 & #4	Included as Shown			$ -		$ -	$ -
	Guard rail - Type GR-01 - at catwalk	Included as Shown			$ -		$ -	$ -
	Guard rail - SS	Included as Shown			$ -		$ -	$ -
	Guard rail - at bridge GR-01 CC	Included as Shown			$ -		$ -	$ -
	Guard rail - Type GR-01D at stone wall	Included as Shown			$ -		$ -	$ -
	Site:							
	Guard rail - type 1	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 1,214,269.00**		**$ 2,833,293.00**	**$ 4,047,562.00**
05 7000	**Ornamental Metals (included w/ other Division 5 sections)**							
06 0000	**WOOD, PLASTICS, and COMPOSITES**							
06 2000	**Capentry**							

	DESCRIPTION OF WORK		QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	Moldings, base, oak, 3 piece, 4-1/2" x 9/16" thick		Included as Shown			$ -		$ -	$ -
	Misc carpentry		1	ls	$ 13,212.00	$ 13,212.00	$ 30,828.00	$ 30,828.00	$ 44,040.00
		Subtotal				**$ 13,212.00**		**$ 30,828.00**	**$ 44,040.00**
06 3000	**Wood Benches**								
	Continous wood bench 36" wide w/ concrete base		1,250	LF	$ 37.43	$ 46,792.00	$ 87.35	$ 109,183.00	$ 155,975.00
		Subtotal				**$ 46,792.00**		**$ 109,183.00**	**$ 155,975.00**
06 4023	**Architectural Woodwork**								
	IPE Wood Casework		355	sf	$ 144.53	$ 51,307.00	$ 337.23	$ 119,715.00	$ 171,022.00
	Wood countertop over 3/4" plywood		Included as Shown			$ -		$ -	$ -
	Grilles & Panels, hardwood, sanded, custom designs, prefinished, 2' x 4' to 4' x 8 '		796	SF	$ 82.99	$ 66,060.00	$ 193.64	$ 154,140.00	$ 220,200.00
	WD-10 Wood Veneer Panel (Multi Purpose Room)		990	SF	$ 22.02	$ 21,800.00	$ 51.38	$ 50,866.00	$ 72,666.00
	x-cost for doors		1	PR	$ 440.00	$ 440.00	$ 1,028.00	$ 1,028.00	$ 1,468.00
	Wood Ceiling - WD03		2,678	SF	$ 19.82	$ 53,073.00	$ 46.24	$ 123,836.00	$ 176,909.00
		Subtotal				**$ 192,680.00**		**$ 449,585.00**	**$ 642,265.00**
07 0000	**THERMAL & MOISTURE PROTECTION**								
07 1326	**Sheet Membrane Waterproofing**								
	Waterproofing @ concrete walls		24,384	SF	$ 2.18	$ 53,062.00	$ 5.08	$ 123,810.00	$ 176,872.00
		Subtotal				**$ 53,062.00**		**$ 123,810.00**	**$ 176,872.00**
07 1413	**Fluid Membrane Waterproofing**								
	Waterproofing @ concrete paving areas		27,225	SF	$ 1.76	$ 47,959.00	$ 4.11	$ 111,906.00	$ 159,865.00
		Subtotal				**$ 47,959.00**		**$ 111,906.00**	**$ 159,865.00**
07 2100	**Thermal Insulation**								
	Rigid insulation (various locations)		25,652	SF	$ 5.72	$ 146,812.00	$ 13.35	$ 342,560.00	$ 489,372.00
	Thermal insulation under SOG		14,725	SF	$ 2.60	$ 38,315.00	$ 6.07	$ 89,401.00	$ 127,716.00
		Subtotal				**$ 185,127.00**		**$ 431,961.00**	**$ 617,088.00**
07 2423	**Direct Applied Soffit Finish System (included w/ section 09000)**								
07 2713	**Non-Permeable, Self-Adhered Air/Vapor Barrier Membrane (included w/ section 044200)**								
07 3360	**Vegetated Roofing System**								
	Green Roof - waterproof, insulation, protection, & topsoil (plantings not included)		15,956	SF	$ 28.34	$ 452,204.00	$ 66.13	$ 1,055,143.00	$ 1,507,347.00
	Pedestrian Path at roof - precast pavers		3,380	SF	$ 22.34	$ 75,494.00	$ 52.12	$ 176,153.00	$ 251,647.00
	Gravel fill at roof perimeter		Included as Shown			$ -		$ -	$ -
	Green Roof - waterproof, protection, & topsoil (plantings not included)		Included as Shown			$ -		$ -	$ -
	Pedestrian Path at roof		Included as Shown			$ -		$ -	$ -

CSI	DESCRIPTION OF WORK	QUANTITY & UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	Gravel fill at roof perimeter	Included as Shown	$ -	$ -		$ -	$ -
	Subtotal		$	**$ 527,698.00**		**$ 1,231,296.00**	**$ 1,758,994.00**
07 6200	**Sheet Metal Flashing and Trim**						
	Perimeter conditioning	Included as Shown	$ -	$ -		$ -	$ -
	Subtotal		$	$ -		$ -	$ -
07 7100	**Roof Specialties and Accessories**						
	Misc flashing and roof accessories	Included as Shown	$ -	$ -		$ -	$ -
	Subtotal		$	$ -		$ -	$ -
07 8413	**Firestops and Smokeseals**						
	Sprayed cementitious fireproofing	NIC	$ -	$ -		$ -	$ -
	Intumescent epoxy fireproofing	NIC	$ -	$ -		$ -	$ -
	Fall Restrained System Tie Back	7 EA	$ 1,459.57	$ 10,217.00	$ 3,405.86	$ 23,841.00	$ 34,058.00
	Subtotal		$	**$ 10,217.00**		**$ 23,841.00**	**$ 34,058.00**
07 9200	**Joint Sealers (included w/ section 090000)**						
07 9500	**Expansion Control (included w/ section 090000)**						
08 0000	**OPENINGS**						
08 1113	**Steel Doors and Frames**						
	Building:						
	Doors, stainless steel and glass, entrance unit, narrow stiles, including hardware, average	With Curtainwal	$ -	$ -		$ -	$ -
	Doors, stainless steel and glass, entrance unit, narrow stiles, including hardware, IGU Glass	With Curtainwal	$ -	$ -		$ -	$ -
	Exterior HM door with frame & hardware - single (stone cladding not included)	17 EA	$ 341.47	$ 5,805.00	$ 796.82	$ 13,546.00	$ 19,351.00
	Exterior HM door with frame & hardware - double (stone cladding not included)	5 PR	$ 924.80	$ 4,624.00	$ 2,158.00	$ 10,790.00	$ 15,414.00
	Fire shutter	1 EA	$ 5,505.00	$ 5,505.00	$ 12,845.00	$ 12,845.00	$ 18,350.00
	Interior HM door with frame & hardware - single	17 EA	$ 418.35	$ 7,112.00	$ 976.24	$ 16,596.00	$ 23,708.00
	Interior HM door with frame & hardware - double	5 PR	$ 682.60	$ 3,413.00	$ 1,592.80	$ 7,964.00	$ 11,377.00
	Closet door, double, wood, architectural, flush, interior, hollow core, luan face, w/ frame & hardware	Included as Shown	$ -	$ -		$ -	$ -
	Wood door, single	Included as Shown	$ -	$ -		$ -	$ -
	Site:						
	Weathering steel gate @ stair #5	1 EA	$ 11,010.00	$ 11,010.00	$ 25,690.00	$ 25,690.00	$ 36,700.00
	Weathering steel gate @ stair #6	1 EA	$ 2,642.00	$ 2,642.00	$ 6,166.00	$ 6,166.00	$ 8,808.00
	Weathering steel grating@cell 7 tail end (11'6"x11'11")	1 EA	$ 18,343.00	$ 18,343.00	$ 42,799.00	$ 42,799.00	$ 61,142.00
	Weahtering steel grating @ cart storage entrance	1 EA	$ 67,672.00	$ 67,672.00	$ 157,901.00	$ 157,901.00	$ 225,573.00
	Weathering steel dove tail grate	Included as Shown	$	$ -		$ -	$ -
	Subtotal		$	**$ 126,126.00**		**$ 294,297.00**	**$ 420,423.00**

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QUAN	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
08 1416	**Wood Doors (included w/ 081113)**							
08 3113	**Access Doors**							
	Doors, specialty, access, fire rated, with lock, metal, 24" x 24"	4	EA	$ 425.50	$ 1,702.00	$ 993.00	$ 3,972.00	$ 5,674.00
	Floor - Access hatch	4	EA	$ 1,651.50	$ 6,606.00	$ 3,853.50	$ 15,414.00	$ 22,020.00
	Subtotal				**$ 8,308.00**		**$ 19,386.00**	**$ 27,694.00**
08 3316	**Coiling Counter Doors**							
	Doors, rolling service, steel, motorized, 11'8" x 8' high, incl. hardware	1	EA	$ 2,686.00	$ 2,686.00	$ 6,269.00	$ 6,269.00	$ 8,955.00
	Doors, rolling service, steel, motorized, 11'8" x 8' high, incl. hardware	1	EA	$ 2,642.00	$ 2,642.00	$ 6,166.00	$ 6,166.00	$ 8,808.00
	Subtotal				**$ 5,328.00**		**$ 12,435.00**	**$ 17,763.00**
08 3323	**Overhead Coiling Doors (included w/ other Division 8 sections)**							
08 3336	**Side Sliding Grills**							
	Doors, steel, sliding, electric, heavy duty, max-customized (motorized)	28	SF	$ 78.64	$ 2,202.00	$ 183.50	$ 5,138.00	$ 7,340.00
	Subtotal				**$ 2,202.00**		**$ 5,138.00**	**$ 7,340.00**
08 4113	**Aluminum Framed Entrances and Structural Glass Curtain Walls**							
	Curtain Wall (including mockups)	2,950	SF	$ 502.20	$ 1,481,488.00	$ 1,171.80	$ 3,456,805.00	$ 4,938,293.00
	Operable units	18	EA	$ 2,642.39	$ 47,563.00	$ 6,165.61	$ 110,981.00	$ 158,544.00
	Subtotal				**$ 1,529,051.00**		**$ 3,567,786.00**	**$ 5,096,837.00**
08 7100	**Finish Hardware (Door Hardware) (included w/ section 08113)**							
08 8000	**Glass and Glazing**							
	Clerestory windows with1" tempered glazing	60	SF	$ 132.12	$ 7,927.00	$ 308.28	$ 18,497.00	$ 26,424.00
	Movable glass panels	315	SF	$ 69.90	$ 22,020.00	$ 163.11	$ 51,380.00	$ 73,400.00
	Doors at glass panels	Included as shown			$ -		$ -	$ -
	Glass panels - single panel tempered glass	Included as shown			$ -		$ -	$ -
	Subtotal				**$ 29,947.00**		**$ 69,877.00**	**$ 99,824.00**
08 9000	**Louvers**							
	Louvers	152	SF	$ 49.04	$ 7,454.00	$ 114.42	$ 17,392.00	$ 24,846.00
	Subtotal				**$ 7,454.00**		**$ 17,392.00**	**$ 24,846.00**
09 0000	**FINISHES**							
09 2400	**Exterior Lath and Plaster (included w/ other Division 9 sections)**							

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI #	DESCRIPTION OF WORK	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST (MATERIAL + LABOR)
09 2900	**Gypsum Drywall**							
	A1 (7/8" Furring Hat Channel, 5/8" Cement Board)	636	SF	$ 3.95	$ 2,512.00	$ 9.22	$ 5,863.00	$ 8,375.00
	A2 (7/8" Furring Hat Channel, 5/8" gypsum board)	1,008	SF	$ 3.92	$ 3,953.00	$ 9.15	$ 9,225.00	$ 13,178.00
	A3 (3-5/8" Stud, 5/8" Cement Board)	384	SF	$ 4.31	$ 1,655.00	$ 10.06	$ 3,862.00	$ 5,517.00
	A3B (3-5/8" Stud, 5/8" Cement Board)	480	SF	$ 4.79	$ 2,298.00	$ 11.17	$ 5,361.00	$ 7,659.00
	A4 (3-5/8" Stud, 5/8" Cement Board)	3,804	SF	$ 4.70	$ 17,896.00	$ 10.98	$ 41,758.00	$ 59,654.00
	A4B (3-5/8" Stud, 5/8" Cement Board)	4,296	SF	$ 4.67	$ 20,054.00	$ 10.89	$ 46,794.00	$ 66,848.00
	B2 (5/8" gypsum board, 3-5/8" Stud, 5/8" gypsum board)	576	SF	$ 4.52	$ 2,605.00	$ 10.56	$ 6,080.00	$ 8,685.00
	B3 (5/8" gypsum board, 3-5/8" Stud, 5/8" gypsum board)	168	SF	$ 3.82	$ 641.00	$ 8.90	$ 1,495.00	$ 2,136.00
	C1 (5/8" gypsum board, (2) 3-5/8" Stud, 5/8" gypsum board)	432	SF	$ 4.60	$ 1,986.00	$ 10.72	$ 4,633.00	$ 6,619.00
	C2 (5/8" gypsum board, (2) 3-5/8" Stud, 5/8" gypsum board)	312	SF	$ 3.96	$ 1,235.00	$ 9.24	$ 2,883.00	$ 4,118.00
	D1 ((2) 5/8" gypsum board, 3-5/8" Stud, (3) 5/8" gypsum board)	708	SF	$ 6.83	$ 4,837.00	$ 15.94	$ 11,286.00	$ 16,123.00
	D1B	624	SF	$ 9.00	$ 5,616.00	$ 21.00	$ 13,104.00	$ 18,720.00
	D2 ((2) 5/8" gypsum board, 3-5/8" Stud, (2) 5/8" gypsum board, 3/4" Ply)	180	SF	$ 8.87	$ 1,596.00	$ 20.69	$ 3,724.00	$ 5,320.00
	D3 ((2) 5/8" gypsum board, 3-5/8" Stud, (3) 5/8" gypsum board)	1,212	SF	$ 8.48	$ 10,279.00	$ 19.79	$ 23,984.00	$ 34,263.00
	D4 ((3-1/2" Millwork, 3/4" Ply, 3-5/8" Stud, (2) 5/8" gypsum board)	1,080	SF	$ 10.58	$ 11,423.00	$ 24.68	$ 26,653.00	$ 38,076.00
	D5 ((2) 5/8" gypsum board, 3-5/8" Stud, (2) 5/8" gypsum board)	120	SF	$ 5.83	$ 699.00	$ 13.59	$ 1,631.00	$ 2,330.00
	D5B ((2) 5/8" gypsum board, 3-5/8" Stud, (2) 5/8" gypsum board, 5/8" Cement Board)	90	SF	$ 4.74	$ 427.00	$ 11.06	$ 995.00	$ 1,422.00
	D6 (5/8" gypsum board, 3-5/8" Stud, 5/8" gypsum board)	276	SF	$ 4.46	$ 1,230.00	$ 10.40	$ 2,870.00	$ 4,100.00
	D8 (5/8" gypsum board, 3-5/8" Stud, 5/8" gypsum board)	576	SF	$ 10.17	$ 5,859.00	$ 23.73	$ 13,670.00	$ 19,529.00
	D9	1,092	SF	$ 6.19	$ 6,757.00	$ 14.44	$ 15,767.00	$ 22,524.00
	D9B ((2) 5/8" gypsum board, 3-5/8" Stud, (2) 5/8" gypsum board, 1/2" Cement Board)	468	SF	$ 7.55	$ 3,534.00	$ 17.62	$ 8,247.00	$ 11,781.00
	D9C ((2) 5/8" gypsum board, 3-5/8" Stud, (2) 5/8" gypsum board	144	SF	$ 5.88	$ 846.00	$ 13.71	$ 1,974.00	$ 2,820.00
	Drywall Partition above Curtain wall as per Detail at A-811	798	SF	$ 0.90	$ 722.00	$ 2.11	$ 1,686.00	$ 2,408.00
	Gypsum Drywall Ceilings, gypsum board, finished, crewed to grid, channel or joists, 1/2" thick	1,616	SF	$ 8.84	$ 14,282.00	$ 20.62	$ 33,324.00	$ 47,606.00
	Ceilings, gypsum board, finished, crewed to grid, channel or joists, 1/2" thick	Included as shown		$ -		$ -	$ -	
	GWB Soffit, finished, screwed to grid, channel or joists	Included as shown		$ -		$ -	$ -	
	Subtotal			**$**	**122,942.00**		**$ 286,869.00**	**$ 409,811.00**
09 3000	**Ceramic Tile**							
	Ceramic tile wall	1,791	SF	$ 5.53	$ 9,900.00	$ 12.90	$ 23,101.00	$ 33,001.00
	Ceramic tile floor	585	SF	$ 5.28	$ 3,091.00	$ 12.33	$ 7,214.00	$ 10,305.00
	Subtotal			**$**	**12,991.00**		**$ 30,315.00**	**$ 43,306.00**
09 3310	**Quarry Tile**							
	Quarry tile floor	378	SF	$ 55.05	$ 20,809.00	$ 128.45	$ 48,554.00	$ 69,363.00
	Glass Mosaics, standard grout, color group 1 & 2, 3/4" tile on 12" sheets	Included as shown		$ -		$ -	$ -	
	Subtotal			**$**	**20,809.00**		**$ 48,554.00**	**$ 69,363.00**
09 5513	**Acoustic Panel Ceilings**							

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QUAN	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
	Acoustic ceiling grid, 2' x 2'	1,457	SF	$ 5.80	$ 8,452.00	$ 13.54	$ 19,722.00	$ 28,174.00
	Subtotal				**$ 8,452.00**		**$ 19,722.00**	**$ 28,174.00**
09 5133	**Metal Ceilings**							
	Metal Ceiling	160	SF	$ 7.96	$ 1,273.00	$ 18.58	$ 2,972.00	$ 4,245.00
	Subtotal				**$ 1,273.00**		**$ 2,972.00**	**$ 4,245.00**
09 6813	**Carpet Tile**							
	Carpet Tile, tufted nylon, 42 oz., 18" x 18" or 24" x 24"	163	SY	$ 112.94	$ 18,409.00	$ 263.52	$ 42,953.00	$ 61,362.00
	Rubber wall base	0	LF		$ -		$ -	$ -
	Subtotal				**$ 18,409.00**		**$ 42,953.00**	**$ 61,362.00**
09 9000	**Painting and Finishing**							
	Paint door and frame	27	EA	$ 66.04	$ 1,783.00	$ 154.15	$ 4,162.00	$ 5,945.00
	Paints & Coatings, siding, exterior, wood shingles, oil base, stain 2 coats, spray		NIC		$ -		$ -	$ -
	Paint ceiling, interior, primer + 2 coat	1,616	SF	$ 1.54	$ 2,491.00	$ 3.60	$ 5,812.00	$ 8,303.00
	Paint Exposed Ceiling - 1st Floor	Included as shown			$ -		$ -	$ -
	Paint wall partition	26,345	SF	$ 0.88	$ 23,205.00	$ 2.06	$ 54,144.00	$ 77,349.00
	Paint special coat at walls	Included as shown			$ -		$ -	$ -
	Misc painting	1	ls	$ 42,247.00	$ 42,247.00	$ 98,575.00	$ 98,575.00	$ 140,822.00
	Paints and protective coatings, epoxy primer, sprayed	Included as shown			$ -		$ -	$ -
	Paints and protective coatings, epoxy topcoat, sprayed	Included as shown			$ -		$ -	$ -
	Paints and protective coatings, inorganic zinc rich primer, self cure, sprayed	Included as shown			$ -		$ -	$ -
	Paints and protective coatings, organic zinc rich primer, epoxy, sprayed	Included as shown			$ -		$ -	$ -
	Green golf mat		NIC		$ -		$ -	$ -
	Misc finishes	1	LS	$ 3,083.00	$ 3,083.00	$ 7,193.00	$ 7,193.00	$ 10,276.00
	Subtotal				**$ 72,809.00**		**$ 169,886.00**	**$ 242,695.00**
10 0000	**SPECIALTIES**							
10 1400	**Signage**							
	S1 - Entrance ID Aluminum Panel Aluminum kick panel Waterjet and bead blasted S.S. Marking (ø=15 1/4", Thk=3/4") Waterjet cut and bead blasted S.S. Letterforms (H=6 3/8", Thk=3/4") Waterjet cut and bead blasted S.S. Letterforms (H=5 3/4", Thk=1/4") Waterjet cut and bead blasted S.S. Letterforms (H= 2 9/16", Thk=1/4") Base plate w/ (4) standard holes (11" x 9 1/2" x 3/4") HSS column, H=15' Max. (5x3x5/16) Footer - Concrete pile ø=16", 8' deep	1	EA	$ 18,620.00	$ 18,620.00	$ 43,447.00	$ 43,447.00	$ 62,067.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
S2 - Site ID Aluminum panel Aluminum kick panel Waterjet cut and bead blasted S.S. Marking (ø=15 1/4", Thk=3/4") Waterjet cut and bead blasted S.S. Letterforms (H= 6 3/8", Thk=3/4") Waterjet cut and bead blasted S.S. Letterforms (H=2 9/16", Thk=1/4") Base plate w/ (4) standard holes (11" x 9 1/2" x 3/4") HSS column, H=15' Max. (5x3x5/16) Footer - Concrete pile ø=16", 8' deep	2	EA	$ 18,620.00	$ 37,240.00	$ 43,447.00	$ 86,894.00	$ 124,134.00
S3 - Wayfinding Signage at Building Entrance Waterjet cut and bead blasted S.S. Letterforms (H=7", Thk=3/4")	1	EA	$ 3,558.00	$ 3,558.00	$ 8,303.00	$ 8,303.00	$ 11,861.00
S4 - Door ID Aluminum panel, sand blasted, w/ cool tinted coating	11	EA	$ 445.73	$ 4,903.00	$ 1,039.91	$ 11,439.00	$ 16,342.00
S5 - Pedestrian Wayfinding Aluminum panel Aluminum wrapper panel Aluminum kick panel Waterjet cut and bead blasted S.S. Marking (ø=5 1/8", Thk=1/4") Waterjet cut and bead blasted S.S. Letterforms (H= 2 1/8", Thk=1/4") Base plate w/ (4) standard holes Square tube, 1 3/4" OD Footer - Concrete pile ø=16", 8' deep	6	EA	$ 1,444.50	$ 8,667.00	$ 3,370.50	$ 20,223.00	$ 28,890.00
S6 - Secondary Pedestrian ID Option 1 Waterjet cut and bead blasted S.S. Letterforms (H=2 1/2", Thk=3/8")	0	EA		$ -		$ -	$ -
S6 - Secondary Pedestrian ID Option 2 Adhesive vinyl lettering (2 1/2" x 30") 0.52 SF	0	EA		$ -		$ -	$ -
S7 - Authorized Only Aluminum panel, sand blasted, w/ cool tint coating (Thk=1/4")	2	EA	$ 445.50	$ 891.00	$ 1,040.00	$ 2,080.00	$ 2,971.00
S8 - DPR Concession Notice, A7 - Hours of Operation Adhesive vinyl lettering (25 3/8" x 17 13/16") 3.14 SF	1	EA	$ 520.00	$ 520.00	$ 1,212.00	$ 1,212.00	$ 1,732.00
L1 - LEED ID Adhesive vinyl lettering (ø=18") 2.25 SF	1	EA	$ 1,180.00	$ 1,180.00	$ 2,754.00	$ 2,754.00	$ 3,934.00
S9 - Building Signage - Tee Box ID Bead blasted SS plate w/ anti slip pattern raised 3/16"	55	EA	$ 1,708.75	$ 93,981.00	$ 3,987.09	$ 219,290.00	$ 313,271.00
S11 - Interpretive Signs Aluminum panel Aluminum wrapper panel Aluminum kick panel Base plate w/ (4) standard holes Square tube, 1 3/4" OD Footer - Concrete pile ø=16", 8' deep	7	EA	$ 4,351.14	$ 30,458.00	$ 10,152.71	$ 71,069.00	$ 101,527.00
S10 - Interpretive Signage at Constructed Wetland 6 Amphitheater	1	EA	$ 44,745.00	$ 44,745.00	$ 104,404.00	$ 104,404.00	$ 149,149.00

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

Description of Work	Quantity	Unit of Measure	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total Cost Material + Labor
Bead blasted SS disc & strip (disc ø=4'-6")							
S12 - Interpretive Signage at Contructed Wetland 6 Amphitheater	1	EA	$ 1,550.00	$ 1,550.00	$ 3,617.00	$ 3,617.00	$ 5,167.00
Bead blasted SS disc & strip (disc ø=4'-6")							
A1 - Office ID	2	EA	$ 445.50	$ 891.00	$ 1,040.00	$ 2,080.00	$ 2,971.00
Aluminum panel, sandlbasted, w/ cool tint coating (Thk=1/4")							
A2 - Tenant ID	2	EA	$ 1,259.50	$ 2,519.00	$ 2,939.00	$ 5,878.00	$ 8,397.00
Aluminum panel, sand blasted, w/ col tint coating (Thk=1/2")							
Waterjet cut and bead blasted S.S. Letterforms (H=4 3/4", Thk=1/2")							
A3 - Special Room ID	3	EA	$ 445.67	$ 1,337.00	$ 1,040.00	$ 3,120.00	$ 4,457.00
Aluminum panel, sand blasted, w/ cool tint coating (Thk=1/4")							
A4 - Service Room ID	6	EA	$ 668.50	$ 4,011.00	$ 1,560.00	$ 9,360.00	$ 13,371.00
Aluminum panel, sandlbasted, w/ cool tint coating (Thk=1/4")							
A5 - Pro Office Green Fees	1	EA	$ 493.00	$ 493.00	$ 1,151.00	$ 1,151.00	$ 1,644.00
Adhesive vinyl lettering (20" x 36") 5 SF							
A8 - Digital Display	1	EA	$ 11,750.00	$ 11,750.00	$ 27,416.00	$ 27,416.00	$ 39,166.00
Samsung UEC series (or equal) large format display 40"x22"							
L2 - LEED Plaque	1	EA	$ 427.00	$ 427.00	$ 997.00	$ 997.00	$ 1,424.00
Arcylic panel (Thk=1/4")							
C1 - Restroom ID	2	EA	$ 451.00	$ 902.00	$ 1,052.00	$ 2,104.00	$ 3,006.00
Aluminum panel, sand blasted, w/ cool tint coating (Thk=1/4")							
C2 - Employee Hand Washing	3	EA	$ 390.33	$ 1,171.00	$ 910.33	$ 2,731.00	$ 3,902.00
Aluminum panel, sand blasted, w/ cool tint coating (Thk=1/4")							
C3 - Stair ID Occupant side	2	EA	$ 644.50	$ 1,289.00	$ 1,504.50	$ 3,009.00	$ 4,298.00
Aluminum panel, sand blasted, w/ cool tint coating (Thk=1/4")							
C4 - Stair ID (Stairwell)	2	EA	$ 519.50	$ 1,039.00	$ 1,212.50	$ 2,425.00	$ 3,464.00
Aluminum panel, sand blasted, w/ cool tint coating (Thk=1/4")							
C5 - Fire Extinguisher	1	EA	$ 467.00	$ 467.00	$ 1,089.00	$ 1,089.00	$ 1,556.00
Painted acrylic panel (Thk= 1/8")							
C6 - Maximum Occupancy	1	EA	$ 520.00	$ 520.00	$ 1,212.00	$ 1,212.00	$ 1,732.00
Arcylic panel (Thk=1/4")							
C7 - Distraction Marking	3	EA	$ 1,098.00	$ 3,294.00	$ 2,562.33	$ 7,687.00	$ 10,981.00
Adhesive vinyl lettering (2'-10" x 40') 114 SF							
C8 - No Smoking Sign	4	EA	$ 445.75	$ 1,783.00	$ 1,039.75	$ 4,159.00	$ 5,942.00
Acrylic panel (Thk=1/4")							
C9 - Restroom Flag ID	2	EA	$ 625.50	$ 1,251.00	$ 1,459.00	$ 2,918.00	$ 4,169.00
Aluminum panel, sand blsated, w/ cool tint coating (Thk=1/8")							
Aluminum tube frame							
P1 - Enter / Exit ID	4	EA	$ 3,294.25	$ 13,177.00	$ 7,686.50	$ 30,746.00	$ 43,923.00
Aluminum panel							
Aluminum wrapper panel							
Aluminum kick panel							
Base plate w/ (4) standard holes							
Square tube, 1 3/4" OD? missing detail							
Footer - Concrete pile ø=16", 8' deep							
P2 - Vehicular Directional	1	EA	$ 4,351.00	$ 4,351.00	$ 10,153.00	$ 10,153.00	$ 14,504.00
Aluminum panel							

CSI	DESCRIPTION OF WORK	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
	Aluminum wrapper panel							
	Aluminum kick panel							
	Base plate w/ (4) standard holes							
	Square tube, 1 3/4" OD							
	Footer - Concrete pile ø=16", 8' deep							
	P3, P5, P7, P9 - Parking	16	EA	$ 1,477.56	$ 23,641.00	$ 3,447.56	$ 55,161.00	$ 78,802.00
	Aluminum panel, painted, (Thk=1/8")							
	Aluminum tube frame							
	Sign post, aluminum square tube, 1 3/4" OD							
	P6 - Parking Rates Information, P8 - Parking Disclaimer	1	EA	$ 678.00	$ 678.00	$ 1,583.00	$ 1,583.00	$ 2,261.00
	Aluminum panel							
	Aluminum wrapper panel							
	Aluminum kick panel							
	Base plate w/ (4) standard holes							
	Square tube, 1 3/4" OD							
	Footer - Concrete pile ø=16", 8' deep							
	Mockups	1	LS	$ 4,404.00	$ 4,404.00	$ 10,276.00	$ 10,276.00	$ 14,680.00
	Site Survey	1	LS	$ 2,202.00	$ 2,202.00	$ 5,138.00	$ 5,138.00	$ 7,340.00
	Subtotal				**$ 327,910.00**		**$ 765,125.00**	**$ 1,093,035.00**
10 2114	**Floor Mounted Toilet Partitions**							
	Urinal Screen, wedge type, stainless steel	1	EA	$ 2,995.00	$ 2,995.00	$ 6,987.00	$ 6,987.00	$ 9,982.00
	Toilet partition	8	EA	$ 44.00	$ 352.00	$ 102.75	$ 822.00	$ 1,174.00
	Subtotal				**$ 3,347.00**		**$ 7,809.00**	**$ 11,156.00**
10 2213	**Wire Mesh Partitions**							
	Woven wire partitions, channel frame, painted, 1-1/2" diamond mesh, 10 ga. wire,	100	SF	$ 40.52	$ 4,052.00	$ 94.54	$ 9,454.00	$ 13,506.00
	Woven wire partitions, lockable door - Single	1	EA	$ 529.00	$ 529.00	$ 1,233.00	$ 1,233.00	$ 1,762.00
	Woven wire partitions, lockable door - double	0	PR		$ -		$ -	$ -
	Subtotal				**$ 4,581.00**		**$ 10,687.00**	**$ 15,268.00**
10 2226	**Operable Partitions (included w/ section 088000)**							
10 2800	**Toilet Accessories**							
	Toilet Accessories, curtain rod, stainless steel, 1" dia x 5' long	2	EA	$ 264.50	$ 529.00	$ 616.50	$ 1,233.00	$ 1,762.00
	Toilet Accessories, towel dispenser, stainless steel, surface mounted	0	EA		$ -		$ -	$ -
	Toilet Accessories, toilet tissue dispenser, stainless steel, surface mounted, single roll	8	EA	$ 26.38	$ 211.00	$ 61.75	$ 494.00	$ 705.00
	Toilet Accessories, sanitary napkin dispenser	1	EA	$ 198.00	$ 198.00	$ 463.00	$ 463.00	$ 661.00
	Toilet Accessories, tampon dispenser	1	EA	$ 198.00	$ 198.00	$ 463.00	$ 463.00	$ 661.00
	Toilet Accessories, diaper changing station, plastic, wall mounted, horizontal	2	EA	$ 815.00	$ 1,630.00	$ 1,901.00	$ 3,802.00	$ 5,432.00
	Toilet Accessories, grab bars, straight, stainless steel,	8	EA	$ 19.75	$ 158.00	$ 46.25	$ 370.00	$ 528.00
	Toilet Accessories, hand dryer, surface mounted, electric,	2	EA	$ 418.50	$ 837.00	$ 976.00	$ 1,952.00	$ 2,789.00
	Toilet Accessories, mirror, 36" x 24", with stainless steel 3/4" square frame	4	EA	$ 88.00	$ 352.00	$ 205.50	$ 822.00	$ 1,174.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QUANTITY	UNIT OF MEAS.	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL	TOTAL COST LABOR
	Toilet Accessories, robe hook, regular, single	4	EA	$ 11.00	$ 44.00	$ 25.75	$ 103.00	$ 147.00	
	Toilet Accessories, toilet seat cover dispenser, stainless steel, surface mounted	2	EA	$ 35.00	$ 70.00	$ 82.50	$ 165.00	$ 235.00	
	Toilet Accessories, waste receptacle, stainless steel	2	EA	$ 143.00	$ 286.00	$ 334.00	$ 668.00	$ 954.00	
	Lockers - FF&E by Concessionaire								
	Locker, bench - at shower		NIC		$ -		$ -	$ -	
	Locker, bench		NIC		$ -		$ -	$ -	
	Subtotal				**$ 4,513.00**		**$ 10,535.00**	**$ 15,048.00**	
10 7500	**Flagpoles**								
	Flagpoles, steel, direct imbedded installation, internal halyard, 50' high	1	EA			$ 20,308.00	$ 20,308.00	$ 20,308.00	
	Subtotal				**$ -**		**$ 20,308.00**	**$ 20,308.00**	
10 9000	**Parking / Access Control Gate**								
	Parking control equipment, parking control software	1	EA	$ 4,706.00	$ 4,706.00	$ 10,981.00	$ 10,981.00	$ 15,687.00	
	Ticket printer & dispenser, parking equipment, standard, rate computing	1	EA	$ 1,982.00	$ 1,982.00	$ 4,624.00	$ 4,624.00	$ 6,606.00	
	Automatic gates, parking equipment, one way, 12' arm	2	EA	$ 2,862.50	$ 5,725.00	$ 6,679.50	$ 13,359.00	$ 19,084.00	
	Parking gates, full sign, 4" letters	1	EA	$ 661.00	$ 661.00	$ 1,541.00	$ 1,541.00	$ 2,202.00	
	Parking gates, vehicle detector, microprocessor based	3	EA	$ 660.67	$ 1,982.00	$ 1,541.33	$ 4,624.00	$ 6,606.00	
	Subtotal				**$ 15,056.00**		**$ 35,129.00**	**$ 50,185.00**	
11 0000	**EQUIPMENT**								
11 0100	**Fall Protection**								
	Maintenance Fall Protection	1	ls	$ 10,217.00	$ 10,217.00	$ 23,841.00	$ 23,841.00	$ 34,058.00	
	Fall safe shelf mounted to precast platform	Included as shown			$ -		$ -	$ -	
	Subtotal				**$ 10,217.00**		**$ 23,841.00**	**$ 34,058.00**	
11 4800	**Athletic & Recreational Equipment**								
	Ball dispenser #1 (Range Sevant Ultima - 45 or equal) [07-01]	1	EA	$ 6,430.00	$ 6,430.00	$ 15,003.00	$ 15,003.00	$ 21,433.00	
	Ball dispenser #2 (Range Sevant Ultima - 19 or equal) [07-02]	1	EA	$ 3,391.00	$ 3,391.00	$ 7,913.00	$ 7,913.00	$ 11,304.00	
	Payment System [07-03]	1	EA	$ 5,017.00	$ 5,017.00	$ 11,705.00	$ 11,705.00	$ 16,722.00	
	Ball Washer Range Servant Ball Washer 1950 or equal [07-04]	1	EA	$ 1,541.00	$ 1,541.00	$ 3,597.00	$ 3,597.00	$ 5,138.00	
	Ball Elevator Range Multi Storey [07-05]	1	EA	$ 1,585.00	$ 1,585.00	$ 3,700.00	$ 3,700.00	$ 5,285.00	
	Disp. Connector Range Servant or equal [07-06]	1	EA	$ 1,938.00	$ 1,938.00	$ 4,521.00	$ 4,521.00	$ 6,459.00	
	Golf ball collection netting [07-07]	18,700	SF	$ 7.04	$ 131,668.00	$ 16.43	$ 307,227.00	$ 438,895.00	
	Tee box divider at open tee box	55	EA	$ 181.13	$ 9,962.00	$ 422.62	$ 23,244.00	$ 33,206.00	
	Subtotal				**$ 161,532.00**		**$ 376,910.00**	**$ 538,442.00**	
12 0000	**FURNISHINGS**								
12 2413	**Window Shades**								
	Shades, woven aluminum, lightproof & fireproof, 3/8" thick	1	ls	$ 10,556.00	$ 10,556.00	$ 24,632.00	$ 24,632.00	$ 35,188.00	
	Subtotal				**$ 10,556.00**		**$ 24,632.00**	**$ 35,188.00**	

Project: Croton Water Treatment Plant Facilities and Landscape Construction DDC ID: CRO-AGS
Location: 3651 Jerome Avenue, Bronx NY 10467 Sponsor Agency: NYC Dept of Environmental Protection
Bidder: C & L Contracting Corp.

CSI	DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
12 4813	**Floor Mats and Frames**							
	Entrance mat	156	SF	$ 41.29	$ 6,442.00	$ 96.37	$ 15,033.00	$ 21,475.00
	Stainless steel floor grating - FT 01	470	SF	$ 71.21	$ 33,470.00	$ 166.17	$ 78,098.00	$ 111,568.00
	Subtotal				**$ 39,912.00**		**$ 93,131.00**	**$ 133,043.00**
12 9300	**Site Furnishings**							
	Building:							
	Engineered stone countertops, color group A, 25" wide, 2" backsplash, maximum	1	ls	$ 5,945.00	$ 5,945.00	$ 13,873.00	$ 13,873.00	$ 19,818.00
	Site:							
	Playground equipment, bike rack, permanent, 10' long	3	EA	$ 1,387.33	$ 4,162.00	$ 3,237.00	$ 9,711.00	$ 13,873.00
	Custom benches, precast base 11'6" X 3' 2 1/2", 4' mounting TYPE 1	Included as shown			$ -		$ -	$ -
	Custom benches, precast base 11'6" X 3' 2 1/2", 8' mounting TYPE 2	Included as shown			$ -		$ -	$ -
	Subtotal				**$ 10,107.00**		**$ 23,584.00**	**$ 33,691.00**
13 0000	**SPECIAL CONSTRUCTION**							
13 3123	**Tensioned Fabric Structures**							
	Canopy framing, structural steel, shop fabricated built up tapered sections	86,180	LBS	$ 5.69	$ 490,011.00	$ 13.27	$ 1,143,359.00	$ 1,633,370.00
	Base plate	27,900	LBS	$ 0.42	$ 11,605.00	$ 0.97	$ 27,077.00	$ 38,682.00
	PTFE fabric including cable bracing to columns	8,000	SF			$ 123.86	$ 990,900.00	$ 990,900.00
	Subtotal				**$ 501,616.00**		**$ 2,161,336.00**	**$ 2,662,952.00**
21 0000	**FIRE SUPPRESSION**							
21 0517	**Sleeves and Sleeve Seals for Fire-Suppression Piping (included w/ 211316)**							
21 0518	**Escutcheons for Fire-Suppression Piping (included w/ 211316)**							
21 0548	**Vibration and Seismic Controls for Fire-Suppression Piping and Equipment**							
	Vibration and Seismic Controls for Fire-Suppression Piping and Equipment	1	LS	$ 7,046.00	$ 7,046.00	$ 16,442.00	$ 16,442.00	$ 23,488.00
	Subtotal				**$ 7,046.00**		**$ 16,442.00**	**$ 23,488.00**
21 0553	**Identification for Fire-Suppression Piping and Equipment**							
	Identification for Fire-Suppression Piping and Equipment	1	ls	$ 2,202.00	$ 2,202.00	$ 5,138.00	$ 5,138.00	$ 7,340.00
	Subtotal				**$ 2,202.00**		**$ 5,138.00**	**$ 7,340.00**
21 1313	**Wet-Pipe Sprinkler Systems**							
	FD Fire siamese connection - 4", ~~free standing~~ Recessed	2	EA	$ 2,642.50	$ 5,285.00	$ 6,165.50	$ 12,331.00	$ 17,616.00

CSI	DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
	Pipe, black sch. 40. - 3"	Included as Shown		$ -	$ -		$ -	$ -
	Pipe, black sch. 40. - 4"	Included as Shown		$ -	$ -		$ -	$ -
	Upright sprinkler head inclg. Black steel piping, sch. 40 up to 2" dia	78	EA	$ 264.24	$ 20,611.00	$ 616.55	$ 48,091.00	$ 68,702.00
	Recessed sprinkler head inclg. Black steel piping, sch. 40 up to 2" dia	79	EA	$ 202.91	$ 16,030.00	$ 473.48	$ 37,405.00	$ 53,435.00
	Check Valve with Drip Ball - 4"	Included as Shown			$ -		$ -	$ -
	4" alarm check valve assembly	Included as Shown			$ -		$ -	$ -
	4" FCVA	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 41,926.00**		**$ 97,827.00**	**$ 139,753.00**
21 1316	**Dry-Pipe Sprinkler Systems**							
	2" dry pipe valve - DVA-1 Viking Total pack2	Included as Shown			$ -		$ -	$ -
	2" Galvanized sch.40	Included as Shown			$ -		$ -	$ -
	Dry sprinkler head inclg. Galvanized steel piping, sch.40 up to 2" dia	12	EA	$ 286.25	$ 3,435.00	$ 667.92	$ 8,015.00	$ 11,450.00
	FP_01, Automatic fire pump, 300 gpm, 25 hp, jp-1 Jockey Pump, 10gpm, 2hp, and control panels	1	SET	$ 28,626.00	$ 28,626.00	$ 66,794.00	$ 66,794.00	$ 95,420.00
	Subtotal				**$ 32,061.00**		**$ 74,809.00**	**$ 106,870.00**
21 3113	**Electric Drive, Centrifugal Fire Pumps (included w/ section 211316)**							
22 0000	**PLUMBING**							
22 0513	**Common Motor Requirements for Plumbing Equipment (included w/ section 221113)**							
22 0517	**Sleeves and Sleeve Seals for Plumbing Piping**							
	Sleeves and Sleeve Seals for Plumbing Piping	1	ls	$ 14,009.00	$ 14,009.00	$ 32,687.00	$ 32,687.00	$ 46,696.00
	Subtotal				**$ 14,009.00**		**$ 32,687.00**	**$ 46,696.00**
22 0518	**Escutcheons for Plumbing Piping (included w/ section 221113)**							
22 0519	**Meters and Gages for Plumbing Piping**							
	4" Water meter and strainer	1	EA	$ 2,902.00	$ 2,902.00	$ 6,770.00	$ 6,770.00	$ 9,672.00
	Sub Meter, 1"	1	EA	$ 1,498.00	$ 1,498.00	$ 3,494.00	$ 3,494.00	$ 4,992.00
	Sub Meter, 1 1/2"	1	EA	$ 1,529.00	$ 1,529.00	$ 3,567.00	$ 3,567.00	$ 5,096.00
	Water meter 3"	1	EA	$ 1,342.00	$ 1,342.00	$ 3,130.00	$ 3,130.00	$ 4,472.00
	Gas sub meter installation, 1"	None Shown			$ -		$ -	$ -
	Subtotal				**$ 7,271.00**		**$ 16,961.00**	**$ 24,232.00**
22 0523	**General-Duty Valves for Plumbing Piping**							
	Temperature mixing valve TMV-1	1	EA	$ 2,059.00	$ 2,059.00	$ 4,805.00	$ 4,805.00	$ 6,864.00

CSI	DESCRIPTION OF WORK		QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
		Subtotal				**$ 2,059.00**		**$ 4,805.00**	**$ 6,864.00**
22 0529	**Hangers and Supports for Plumbing Piping and Equipment (included w/ section 230533)**								
22 0533	**Heat Tracing for Plumbing Piping (included w/ section 221113)**								
22 0533	**Identification for Plumbing Piping and Equipment**								
	Identification for plumbing Piping		1	ls	$ 2,059.00	$ 2,059.00	$ 8,237.00	$ 8,237.00	$ 10,296.00
		Subtotal				**$ 2,059.00**		**$ 8,237.00**	**$ 10,296.00**
22 0719	**Plumbing Piping Insulation**								
	Pipe insulation 1/2" - 2" iron pipe		1	ls	$ 47,698.00	$ 47,698.00	$ 111,297.00	$ 111,297.00	$ 158,995.00
	Pipe insulation 2 1/2" and above		Included as Shown			$ -		$ -	$ -
		Subtotal				**$ 47,698.00**		**$ 111,297.00**	**$ 158,995.00**
22 1113	**Facility Water Distribution Piping**								
	Pipe, copper, 3" diameter		Included as Shown			$ -		$ -	$ -
	Pipe, copper, 4" diameter		Included as Shown			$ -		$ -	$ -
	Rain water piping:								
	1 1/2" Copper, Type L, includes fittings and hangers		Included as Shown			$ -		$ -	$ -
	2" Copper, Type L, includes fittings and hangers		255	LF	$ 29.02	$ 7,399.00	$ 35.46	$ 9,043.00	$ 16,442.00
	Domestic Water Pumps:								
	HWRP-1, Inline hot water circulation pump - 3 gpm, 10' hd.		1	EA	$ 2,053.00	$ 2,053.00	$ 391.00	$ 391.00	$ 2,444.00
	Domestic-Water Packaged Booster Pumps								
	DWB-1, Simplex, 35 gpm, 1 1/2" hp		1	EA	$ 118,976.00	$ 118,976.00	$ 16,224.00	$ 16,224.00	$ 135,200.00
	Pump-1B and -1B, Duplex, 75 gpm, 100' hd, 5hp each		2	EA	$ 77,235.50	$ 154,471.00	$ 25,745.50	$ 51,491.00	$ 205,962.00
	15 hp VFD		Included as Shown			$ -		$ -	$ -
	5 hp VFD		Included as Shown			$ -		$ -	$ -
		Subtotal				**$ 282,899.00**		**$ 77,149.00**	**$ 360,048.00**
22 1116	**Domestic Water Piping**								
	Pipe, copper, 1/2" diameter		700	LF	$ 22.88	$ 16,016.00	$ 22.88	$ 16,016.00	$ 32,032.00
	Pipe, copper, 3/4" diameter		Included as Shown			$ -		$ -	$ -
	Pipe, copper, 1" diameter		170	LF	$ 24.34	$ 4,137.00	$ 29.75	$ 5,057.00	$ 9,194.00
	Pipe, copper, 1 1/4" diameter		250	LF	$ 31.20	$ 7,800.00	$ 31.20	$ 7,800.00	$ 15,600.00
	Pipe, copper, 1 1/2" diameter		Included as Shown			$ -		$ -	$ -
	Pipe, copper, 2" diameter		250	LF	$ 33.28	$ 8,320.00	$ 33.28	$ 8,320.00	$ 16,640.00
	Pipe, copper, 2 1/2" diameter		490	LF	$ 102.33	$ 50,144.00	$ 68.22	$ 33,430.00	$ 83,574.00
		Subtotal				**$ 86,417.00**		**$ 70,623.00**	**$ 157,040.00**
22 1119	**Domestic Water Piping Specialties**								
	4" MICV/MOCV		1	EA	$ 250.00	$ 250.00	$ 582.00	$ 582.00	$ 832.00
	3/4" RPV		1	EA	$ 243.00	$ 243.00	$ 568.00	$ 568.00	$ 811.00
	1" RPZ		1	EA	$ 265.00	$ 265.00	$ 619.00	$ 619.00	$ 884.00
	1 1/2" RPZ		1	EA	$ 328.00	$ 328.00	$ 764.00	$ 764.00	$ 1,092.00

	DESCRIPTION OF WORK	QUAN.	UNIT MEAS.	LABOR UNIT COST	LABOR TOTAL	EQUIP. UNIT COST	EQUIP. TOTAL	TOTAL MATERIAL & LABOR
	2" RPZ	1	EA	$ 780.00	$ 780.00	$ 1,820.00	$ 1,820.00	$ 2,600.00
	2" DCV	1	EA	$ 780.00	$ 780.00	$ 1,820.00	$ 1,820.00	$ 2,600.00
	4" RPZ	1	EA	$ 1,310.00	$ 1,310.00	$ 3,058.00	$ 3,058.00	$ 4,368.00
	4" DDCV	1	EA	$ 1,466.00	$ 1,466.00	$ 3,422.00	$ 3,422.00	$ 4,888.00
	3/4" HB	1	EA	$ 62.00	$ 62.00	$ 146.00	$ 146.00	$ 208.00
	Capped and valve for future	1	EA	$ 312.00	$ 312.00	$ 728.00	$ 728.00	$ 1,040.00
	Trap primer valve w/ 1/2" distribution piping	1	EA	$ 2,434.00	$ 2,434.00	$ 5,678.00	$ 5,678.00	$ 8,112.00
	Hydrant, ground box type, bronze frame, non-freeze, all bronze, polished face, set flush, 3/4"ips connection, 3/4"ips connection, 2 feet depth bury	4	EA	$ 263.25	$ 1,053.00	$ 614.25	$ 2,457.00	$ 3,510.00
	Subtotal				**$ 9,283.00**		**$ 21,662.00**	**$ 30,945.00**
22 1123.13	**Domestic Water Packaged Booster Pumps (included w/ section 221119)**							
22 1316	**Sanitary Waste and Vent Piping**							
	1 1/2"-2" CI, Hub and Spigot soil pipe and fittings	Included as Shown			$ -		$ -	$ -
	3" CI, Hub and Spigot soil pipe and fittings	1,140	LF	$ 16.68	$ 19,019.00	$ 38.93	$ 44,379.00	$ 63,398.00
	4" CI, Hub and Spigot soil pipe and fittings	1,100	LF	$ 20.90	$ 22,994.00	$ 48.78	$ 53,654.00	$ 76,648.00
	6" CI, Hub and Spigot soil pipe and fittings	Included as Shown			$ -		$ -	$ -
	1 1/2"-2" CI, No Hub, soil pipe and hangers	655	LF	$ 28.03	$ 18,358.00	$ 52.05	$ 34,094.00	$ 52,452.00
	3" CI, No Hub, soil pipe and hangers	Included as Shown			$ -		$ -	$ -
	4" CI, No Hub, soil pipe and hangers	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 60,371.00**		**$ 132,127.00**	**$ 192,498.00**
22 1319	**Sanitary Waste Piping Specialties**							
	4" Sanitary house trap							
	CODP	17	EA	$ 124.82	$ 2,122.00	$ 291.18	$ 4,950.00	$ 7,072.00
	WCO	6	EA	$ 62.33	$ 374.00	$ 145.67	$ 874.00	$ 1,248.00
	3" FAI	3	EA	$ 50.00	$ 150.00	$ 116.33	$ 349.00	$ 499.00
	VTR	2	EA	$ 64.00	$ 128.00	$ 149.00	$ 298.00	$ 426.00
	Sanitary drains							
	3"-4 FD-1, Floor drain	6	EA	$ 234.00	$ 1,404.00	$ 156.00	$ 936.00	$ 2,340.00
	3"-4 FD-2, Floor drain	32	EA	$ 234.00	$ 7,488.00	$ 156.00	$ 4,992.00	$ 12,480.00
	6" Funnel drain	6	EA	$ 39.00	$ 234.00	$ 26.00	$ 156.00	$ 390.00
	FD-4, Floor sink	1	EA	$ 2,227.00	$ 2,227.00	$ 955.00	$ 955.00	$ 3,182.00
	Grease trap interceptor, cast iron	1	EA	$ 7,238.00	$ 7,238.00	$ 4,826.00	$ 4,826.00	$ 12,064.00
	Subtotal				**$ 21,365.00**		**$ 18,336.00**	**$ 39,701.00**
22 1329	**Sanitary Sewerage Pumps**							
	Grey water recycling system, BRAC SGW-2000, inclg. 1000 gal primary tank w/chlorination, blue dye, gw-1 pump, sand filter, expansion tank and accessories	1	SYS	$ 185,619.00	$ 185,619.00	$ 46,405.00	$ 46,405.00	$ 232,024.00
	Subtotal				**$ 185,619.00**		**$ 46,405.00**	**$ 232,024.00**
22 1413	**Facility Storm Drainage Piping**							
	8" CI, Hub and Spigot soil pipe and fittings	Included as Shown			$ -		$ -	$ -
	3" CI, No Hub, soil pipe and hangers	865	LF	$ 23.40	$ 20,241.00	$ 54.60	$ 47,229.00	$ 67,470.00

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	Description of Work	QNTY	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	4" CI, No Hub, soil pipe and hangers	405	LF	$ 38.84	$ 15,732.00	$ 47.48	$ 19,228.00	$ 34,960.00
	6" CI, No Hub, soil pipe and hangers	435	LF	$ 47.84	$ 20,810.00	$ 71.76	$ 31,216.00	$ 52,026.00
	8" CI, No Hub, soil pipe and hangers	175	LF	$ 43.06	$ 7,535.00	$ 100.46	$ 17,581.00	$ 25,116.00
	8" Overflow piping, CI, No Hub, soil pipe and hangers	Included as Shown			$ -		$ -	$ -
	12" Overflow piping, CI, No Hub, soil pipe and hangers	Included as Shown			$ -		$ -	$ -
	24" Overflow piping, CI, No Hub, soil pipe and hangers	Included as Shown			$ -		$ -	$ -
	Facility Storm Drains							
	Drain, roof, main, cast iron body, 12" poly dome, 2", 3" and 4" pipe size	32	EA	$ 340.69	$ 10,902.00	$ 314.50	$ 10,064.00	$ 20,966.00
	Facility Trench Drains	Included as Shown			$ -		$ -	$ -
	TD-1, Trench draing, 10' long	4	EA	$ 1,776.00	$ 7,104.00	$ 2,170.75	$ 8,683.00	$ 15,787.00
	TD-1, Trench drain, 3' long	Included as Shown			$ -		$ -	$ -
	3" CI, No Hub, soil pipe and hangers	465	LF	$ 39.31	$ 18,280.00	$ 73.01	$ 33,949.00	$ 52,229.00
	Drain, roof, main, cast iron body, 12" poly dome, 2", 3" and 4" pipe size	31	EA	$ 328.84	$ 10,194.00	$ 315.97	$ 9,795.00	$ 19,989.00
	Subtotal				**$ 110,798.00**		**$ 177,745.00**	**$ 288,543.00**
22 1423	**Storm Drainage Piping Specialties**							
	Storm Drainage Piping Specialties							
	CODP	4	EA	$ 93.50	$ 374.00	$ 218.50	$ 874.00	$ 1,248.00
	Natural Gas Piping							
	Final connections to DWH's and HVAC	1	ls	$ 1,040.00	$ 1,040.00	$ 4,160.00	$ 4,160.00	$ 5,200.00
	Final connections to Kitchen equipment		NIC		$ -		$ -	$ -
	Final connections to infrared heaters	15	EA	$ -	$ -	$ 156.00	$ 2,340.00	$ 2,340.00
	Piping, black iron, threaded, 3/4" diameter	Included as Shown			$ -		$ -	$ -
	Piping, cast iron, welded, 3" diameter		NIC		$ -		$ -	$ -
	Final connections to infrared heaters	Included as Shown			$ -		$ -	$ -
	Piping, black iron, threaded, 1" diameter	865	LF	$ 19.97	$ 17,272.00	$ 46.59	$ 40,302.00	$ 57,574.00
	Piping, black iron, threaded, 1 1/4" diameter	25	LF	$ 21.52	$ 538.00	$ 50.24	$ 1,256.00	$ 1,794.00
	Piping, black iron, welded, 3" diameter	615	LF	$ 34.94	$ 21,490.00	$ 81.54	$ 50,145.00	$ 71,635.00
	Gas meter rig, inclg. Regulator, shut off valve	2	EA	$ 1,248.00	$ 2,496.00	$ 2,912.00	$ 5,824.00	$ 8,320.00
	GB-1, Gas booster system, Simplex Spencer#SYS0325.5vs (or equal)	1	EA	$ 14,196.00	$ 14,196.00	$ 33,124.00	$ 33,124.00	$ 47,320.00
	Gas Safety Cabinet		NIC		$ -		$ -	$ -
	Subtotal				**$ 57,406.00**		**$ 138,025.00**	**$ 195,431.00**
22 1429	**Sump Pumps**							
	Sump Pumps	1	LS	$ 1,716.00	$ 1,716.00	$ 4,004.00	$ 4,004.00	$ 5,720.00
	Subtotal				**$ 1,716.00**		**$ 4,004.00**	**$ 5,720.00**
22 3400	**Fuel-Fired, Domestic-Water Heaters**							
	WH-1, 140 gal, PVI, 50L 130AGCML	1	EA	$ 15,444.00	$ 15,444.00	$ 36,036.00	$ 36,036.00	$ 51,480.00
	Subtotal				**$ 15,444.00**		**$ 36,036.00**	**$ 51,480.00**
22 4213.13	**Commercial Water Closets**							
	WC-1, -2, Water closet	8	EA	$ 436.75	$ 3,494.00	$ 1,019.25	$ 8,154.00	$ 11,648.00
	Subtotal				**$ 3,494.00**		**$ 8,154.00**	**$ 11,648.00**

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
22 4213.16 Commercial Urinals							
Urinal, wall hung, vitreous china, with hanger & self-closing valve	2	EA	$ 429.00	$ 858.00	$ 1,001.00	$ 2,002.00	$ 2,860.00
Subtotal				**$ 858.00**		**$ 2,002.00**	**$ 2,860.00**
22 4216.13 Commercial Lavatories							
Lavatory, in counter	6	EA	$ 436.83	$ 2,621.00	$ 1,019.17	$ 6,115.00	$ 8,736.00
Subtotal				**$ 2,621.00**		**$ 6,115.00**	**$ 8,736.00**
22 4216.16 Commercial Sinks							
Lavatory, in counter		NIC		$ 367.00		$ 855.00	$ 1,222.00
Subtotal				**$ 367.00**		**$ 855.00**	**$ 1,222.00**
22 4223 Commercial Showers Receptors & Basins							
Shower unit	1	EA	$ 593.00	$ 593.00	$ 1,383.00	$ 1,383.00	$ 1,976.00
Faucets/fittings, sillcock, compact brass	Included as Shown			$ -		$ -	$ -
Subtotal				**$ 593.00**		**$ 1,383.00**	**$ 1,976.00**
22 4500 Emergency Plumbing Fixtures							
Industrial safety fixture, eye wash fountain, W/tmv	1	EA	$ 1,092.00	$ 1,092.00	$ 2,548.00	$ 2,548.00	$ 3,640.00
Subtotal				**$ 1,092.00**		**$ 2,548.00**	**$ 3,640.00**
22 4713 Drinking Fountains							
DrinkingWater Fountains:							
DF-1, Dual	1	EA	$ 780.00	$ 780.00	$ 1,820.00	$ 1,820.00	$ 2,600.00
Subtotal				**$ 780.00**		**$ 1,820.00**	**$ 2,600.00**
23 0000 HEATING, VENTILATING, & AIR-CONDITIONING (HVAC)							
23 0010 Mechanical General Conditions							
Rigging equipment	150	HRS	$ 90.00	$ 13,500.00	$ 210.00	$ 31,500.00	$ 45,000.00
Subtotal				**$ 13,500.00**		**$ 31,500.00**	**$ 45,000.00**
23 0130.51 HVAC Air-Distribution System Cleaning (included w/ other Division 23 sections)							
23 0513 Common Motor Requirements for HVAC equipment							
Air Separator - AS-1, 2 - 10", 125 PSIG	2	EA	$ 1,020.00	$ 2,040.00	$ 2,380.00	$ 4,760.00	$ 6,800.00
Air Separator - RAS-1-12", 125 PSIG	1	EA	$ 1,020.00	$ 1,020.00	$ 2,380.00	$ 2,380.00	$ 3,400.00
Subtotal				**$ 3,060.00**		**$ 7,140.00**	**$ 10,200.00**
23 0516 Expansion Fittings and Loops for HVAC Piping							
Expansion Tank - ET-1, 16 Gals	1	EA	$ 1,380.00	$ 1,380.00	$ 3,220.00	$ 3,220.00	$ 4,600.00
Expansion Tank - ET-2, 7.4 Gals	1	EA	$ 1,290.00	$ 1,290.00	$ 3,010.00	$ 3,010.00	$ 4,300.00
Expansion Tank - RET-1, 8 Gals	1	EA	$ 1,200.00	$ 1,200.00	$ 2,800.00	$ 2,800.00	$ 4,000.00
Subtotal				**$ 3,870.00**		**$ 9,030.00**	**$ 12,900.00**

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QUAN	QTY UNITS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL	TOTAL COST LABOR
23 0517	**Sleeves and Sleeve Seals for HVAC Piping**								
	PVC schedule 40 sleeve different size	45	LF	$ 30.00	$ 1,350.00	$ 70.00	$ 3,150.00	$	4,500.00
	Subtotal				**$ 1,350.00**		**$ 3,150.00**	**$**	**4,500.00**
23 0519	**Meters and Gages for HVAC Piping (included w/ section 232113)**								
23 0523	**General-Duty Valves for HVAC Piping (included w/ section 232113)**								
23 0529	**Hangers and Supports for HVAC Piping and Equipment (indluded w/ section 232113 and 237200)**								
23 0533	**Heat Tracing for HVAC Piping**								
	Heat Tracing for HVAC Piping	1	LS	$ 7,557.00	$ 7,557.00	$ 17,633.00	$ 17,633.00	$	25,190.00
	Subtotal				**$ 7,557.00**		**$ 17,633.00**	**$**	**25,190.00**
23 0548	**Vibration Controls for HVAC (included w/ section 232113 and 237200)**								
23 0553	**Identification for HVAC Piping and Equipment**								
	Identification, cleaning	1	ls	$ 1,350.00	$ 1,350.00	$ 3,150.00	$ 3,150.00	$	4,500.00
	Subtotal				**$ 1,350.00**		**$ 3,150.00**	**$**	**4,500.00**
23 0593	**Testing, Adjusting, and Balancing for HVAC**								
	Testing & Balancing	40	HRS	$ 76.50	$ 3,060.00	$ 178.50	$ 7,140.00	$	10,200.00
	Subtotal				**$ 3,060.00**		**$ 7,140.00**	**$**	**10,200.00**
23 0713	**Duct Installation**								
	Duct Insulation	18,335	SF	$ 0.45	$ 8,251.00	$ 1.05	$ 19,252.00	$	27,503.00
	Acoustic Lining	1,100	SF	$ 0.60	$ 660.00	$ 1.40	$ 1,540.00	$	2,200.00
	Subtotal				**$ 8,911.00**		**$ 20,792.00**	**$**	**29,703.00**
23 0716	**HVAC Equipment Insulation**								
	HVAC Equipment Insulation	2,800	SF	$ 0.45	$ 1,260.00	$ 1.05	$ 2,940.00	$	4,200.00
	Subtotal				**$ 1,260.00**		**$ 2,940.00**	**$**	**4,200.00**
23 0719	**HVAC Piping Insulation**								
	Piping Insulation	2,025	LF	$ 0.90	$ 1,822.00	$ 2.10	$ 4,253.00	$	6,075.00
	Subtotal				**$ 1,822.00**		**$ 4,253.00**	**$**	**6,075.00**
23 0800	**Commissioning of HVAC and Plumbing Systems**								
	Commissioning	1	ls	$ -	$ -	$ 8,700.00	$ 8,700.00	$	8,700.00
	Subtotal				**$ -**		**$ 8,700.00**	**$**	**8,700.00**
23 0900	**Instrumentation and Control for HVAC**								

Project: Croton Water Treatment Plant Facilities and Landscape Construction DDC ID: CRO-AGS
Location: 3651 Jerome Avenue, Bronx NY 10467 Sponsor Agency: NYC Dept of Environmental Protection
Bidder: C & L Contracting Corp.

CSI	Description of Work	Quantity	Unit of Meas	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total Cost Material & Labor
	Thermostat/Humidistat	12	EA	$ 1,740.00	$ 20,880.00	$ 4,060.00	$ 48,720.00	$ 69,600.00
	Thermostat/Humidistat	12	EA	$ 1,590.00	$ 19,080.00	$ 3,710.00	$ 44,520.00	$ 63,600.00
	CO2 Sensor	8	EA	$ 225.00	$ 1,800.00	$ 525.00	$ 4,200.00	$ 6,000.00
	DDC Controls	125	PTS	$ 615.00	$ 76,875.00	$ 1,435.00	$ 179,375.00	$ 256,250.00
	Control Componenets/DDC Systems, incl. material & labor, control points	105	PTS	$ 585.00	$ 61,425.00	$ 1,365.00	$ 143,325.00	$ 204,750.00
	Subtotal				**$ 180,060.00**		**$ 420,140.00**	**$ 600,200.00**
23 0993	**Sequence of Operations for HVAC Controls (included w/ section 230900)**							
23 2113	**Hydronic Piping**							
	4" DEWATERING - Schedule-40	200	LF	$ 42.00	$ 8,400.00	$ 98.00	$ 19,600.00	$ 28,000.00
	3" DEWATERING - Schedule-40	150	LF	$ 36.00	$ 5,400.00	$ 84.00	$ 12,600.00	$ 18,000.00
	4" SOURCE - Schedule-40	50	LF	$ 42.00	$ 2,100.00	$ 98.00	$ 4,900.00	$ 7,000.00
	3" SOURCE - Schedule-40	100	LF	$ 36.00	$ 3,600.00	$ 84.00	$ 8,400.00	$ 12,000.00
	3" DTW - Schedule-40	20	LF	$ 450.00	$ 9,000.00	$ 1,050.00	$ 21,000.00	$ 30,000.00
	2 1/2" DTW - Schedule-40	200	LF	$ 30.00	$ 6,000.00	$ 70.00	$ 14,000.00	$ 20,000.00
	2" DTW - Copper "L"	400	LF	$ 24.00	$ 9,600.00	$ 56.00	$ 22,400.00	$ 32,000.00
	1.5" DTW - Copper "L"	100	LF	$ 18.00	$ 1,800.00	$ 42.00	$ 4,200.00	$ 6,000.00
	1" DTW - Copper "L"	150	LF	$ 15.60	$ 2,340.00	$ 36.40	$ 5,460.00	$ 7,800.00
	2" RF - Copper "L"	400	LF	$ 2.40	$ 960.00	$ 5.60	$ 2,240.00	$ 3,200.00
	1.5" RF - Copper "L"	100	LF	$ 18.00	$ 1,800.00	$ 42.00	$ 4,200.00	$ 6,000.00
	Subtotal				**$ 51,000.00**		**$ 119,000.00**	**$ 170,000.00**
23 2123	**Hydronic Pumps**							
	P-1 - 128 GPM, 1 HP (TACO - KS2006 or equal)	1	EA	$ 2,220.00	$ 2,220.00	$ 5,180.00	$ 5,180.00	$ 7,400.00
	P-2C - 84.5GPM , 2HP (TACO - KS2006 or equal)	1	EA	$ 2,700.00	$ 2,700.00	$ 6,300.00	$ 6,300.00	$ 9,000.00
	P-2H - 96 GPM, 1 HP (TACO - KS2006 or equal)	1	EA	$ 2,760.00	$ 2,760.00	$ 6,440.00	$ 6,440.00	$ 9,200.00
	P-5 - 50 GPM, 1/3 HP (TACO - KS2006 or equal)	1	EA	$ 1,890.00	$ 1,890.00	$ 4,410.00	$ 4,410.00	$ 6,300.00
	Subtotal				**$ 9,570.00**		**$ 22,330.00**	**$ 31,900.00**
23 2500	**HVAC Water Treatment**							
	4" Breeching /Stack	1	ls	$ 4,140.00	$ 4,140.00	$ 9,660.00	$ 9,660.00	$ 13,800.00
	4" Combustion Air	1	ls	$ 2,070.00	$ 2,070.00	$ 4,830.00	$ 4,830.00	$ 6,900.00
	Subtotal				**$ 6,210.00**		**$ 14,490.00**	**$ 20,700.00**
23 3113	**Metal Ducts**							
	Galvanized Sheetmetal	24,000	LBS	$ 7.50	$ 180,000.00	$ 17.50	$ 420,000.00	$ 600,000.00
	Kitchen Exhaust Duct	200	LBS	$ 15.90	$ 3,180.00	$ 37.10	$ 7,420.00	$ 10,600.00
	Subtotal				**$ 183,180.00**		**$ 427,420.00**	**$ 610,600.00**
23 3300	**Air Duct Accessories**							
	FSD/FD& AD:							
	Fire Smoke Damper 36X12	7	EA	$ 660.00	$ 4,620.00	$ 1,540.00	$ 10,780.00	$ 15,400.00
	FSD 14X12	4	EA	$ 480.00	$ 1,920.00	$ 1,120.00	$ 4,480.00	$ 6,400.00
	FSD 12" DIA	1	EA	$ 420.00	$ 420.00	$ 980.00	$ 980.00	$ 1,400.00
	Fire Damper 40X12	2	EA	$ 81.00	$ 162.00	$ 189.00	$ 378.00	$ 540.00

Project: Croton Water Treatment Plant Facilities and Landscape Construction DDC ID: CRO-AGS
Location: 3651 Jerome Avenue, Bronx NY 10467 Sponsor Agency: NYC Dept of Environmental Protection
Bidder: C & L Contracting Corp.

CSI	DESCRIPTION OF WORK	QNTY	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
	FD 36X12	1	EA	$ 81.00	$ 81.00	$ 189.00	$ 189.00	$ 270.00
	FD 18" DIA	1	EA	$ 75.00	$ 75.00	$ 175.00	$ 175.00	$ 250.00
	FD 18X10	3	EA	$ 70.00	$ 210.00	$ 163.33	$ 490.00	$ 700.00
	FD 14X12	1	EA	$ 75.00	$ 75.00	$ 175.00	$ 175.00	$ 250.00
	FD 12" DIA	1	EA	$ 75.00	$ 75.00	$ 175.00	$ 175.00	$ 250.00
	FD 10X10	1	EA	$ 135.00	$ 135.00	$ 315.00	$ 315.00	$ 450.00
	Subtotal				**$ 7,773.00**		**$ 18,137.00**	**$ 25,910.00**
23 3416	**Centrifugal HVAC Fans**							
	EF-1 - 1400 CFM, 1/2 HP	1	EA	$ 408.00	$ 408.00	$ 952.00	$ 952.00	$ 1,360.00
	EF-2 - 150CFM, 1/30 HP	1	EA	$ 375.00	$ 375.00	$ 875.00	$ 875.00	$ 1,250.00
	EF-3 - 1500 CFM, 3/4 HP	1	EA	$ 828.00	$ 828.00	$ 1,932.00	$ 1,932.00	$ 2,760.00
	SF-1 - 1400 CFM, 1/2" WG	1	EA	$ 408.00	$ 408.00	$ 952.00	$ 952.00	$ 1,360.00
	Subtotal				**$ 2,019.00**		**$ 4,711.00**	**$ 6,730.00**
23 3600	**Air Terminal Units (included w/ other Division 23 sections)**							
23 3713	**Diffusers, Registers, and Grilles**							
	Supply Diffusers SD-1							
	225 CFM	5	EA	$ 72.00	$ 360.00	$ 168.00	$ 840.00	$ 1,200.00
	200 CFM	15	EA	$ 72.00	$ 1,080.00	$ 168.00	$ 2,520.00	$ 3,600.00
	175 CFM	8	EA	$ 72.00	$ 576.00	$ 168.00	$ 1,344.00	$ 1,920.00
	Supply Diffusers SD-2							
	1050 CFM	5	EA	$ 81.00	$ 405.00	$ 189.00	$ 945.00	$ 1,350.00
	Return Diffusers RD-1							
	300 CFM	1	EA	$ 288.00	$ 288.00	$ 672.00	$ 672.00	$ 960.00
	250 CFM	1	EA	$ 288.00	$ 288.00	$ 672.00	$ 672.00	$ 960.00
	175 CFM	1	EA	$ 288.00	$ 288.00	$ 672.00	$ 672.00	$ 960.00
	150 CFM	1	EA	$ 288.00	$ 288.00	$ 672.00	$ 672.00	$ 960.00
	100 CFM	1	EA	$ 288.00	$ 288.00	$ 672.00	$ 672.00	$ 960.00
	Return Diffusers RD-2	2	EA	$ 72.00	$ 144.00	$ 168.00	$ 336.00	$ 480.00
	Return Diffusers RD-3 580 CFM	2	EA	$ 72.00	$ 144.00	$ 168.00	$ 336.00	$ 480.00
	Lieanr Diffuser 2-Slots- LD-1	20	EA	$ 72.00	$ 1,440.00	$ 168.00	$ 3,360.00	$ 4,800.00
	PH-1 Penthouse Louver 3.5 SF	1	EA	$ 450.00	$ 450.00	$ 1,050.00	$ 1,050.00	$ 1,500.00
	Subtotal				**$ 6,039.00**		**$ 14,091.00**	**$ 20,130.00**
23 4100	**Particulate Air Filtration (included w/ section 237200)**							
23 5533	**Fuel-Fired Units Heaters**							
	Infrared Gas Heater w/ Switch & Vent	15	EA	$ 174.00	$ 2,610.00	$ 406.00	$ 6,090.00	$ 8,700.00
	Subtotal				**$ 2,610.00**		**$ 6,090.00**	**$ 8,700.00**
23 5700	**Heat Exchangers for HVAC**							
	Boilers							
	B-1, B-2 - 299 MBH	2	EA	$ 5,100.00	$ 10,200.00	$ 11,900.00	$ 23,800.00	$ 34,000.00
	Heat-Exchangers for HVAC							
	HX-1 - 639450 BTU/HR - 128/128 GPM	1	EA	$ 2,580.00	$ 2,580.00	$ 6,020.00	$ 6,020.00	$ 8,600.00

CSI	DESCRIPTION OF WORK	QUAN	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	RHX-1 - 62300 BTU/HR - 6.4/25.1 GPM	3	EA	$ 450.00	$ 1,350.00	$ 1,050.00	$ 3,150.00	$ 4,500.00
	Subtotal				**$ 14,130.00**		**$ 32,970.00**	**$ 47,100.00**
23 7200	**Air-to-Air Energy Recovery Equipment**							
	ERV-1 - Energy Recovery Ventilator 1 Unit 2 Fans - 900 CFM	1	EA	$ 3,210.00	$ 3,210.00	$ 7,490.00	$ 7,490.00	$ 10,700.00
	ERV-2 - Energy Recovery Ventilator 1 Unit 2 Fans - 400 CFM	1	EA	$ 2,910.00	$ 2,910.00	$ 6,790.00	$ 6,790.00	$ 9,700.00
	ERV-4 - Energy Recovery Ventilator 1 Unit 2 Fans - 950 CFM	1	EA	$ 3,210.00	$ 3,210.00	$ 7,490.00	$ 7,490.00	$ 10,700.00
	ERV-5 - Energy Recovery Ventilator 1 Unit 2 Fans - 3000 CFM	1	EA	$ 4,350.00	$ 4,350.00	$ 10,150.00	$ 10,150.00	$ 14,500.00
	ERV-6 - Energy Recovery Ventilator 1 Unit 2 Fans - 2000 CFM	1	EA	$ 4,140.00	$ 4,140.00	$ 9,660.00	$ 9,660.00	$ 13,800.00
	Subtotal				**$ 17,820.00**		**$ 41,580.00**	**$ 59,400.00**
23 7313	**Modular Indoor Central-Station Air-Handling Units**							
	ERV-7 - Energy Recovery Ventilator (Heat Wheel) and Coil Unit - 2000 CFM	1	EA	$ 5,400.00	$ 5,400.00	$ 12,600.00	$ 12,600.00	$ 18,000.00
	Subtotal				**$ 5,400.00**		**$ 12,600.00**	**$ 18,000.00**
23 8146	**Water-Source Unitary Heat Pumps**							
	HP-1,2 - Water to Water Heat Pump-Geothermal Ground Source, 260 MBH (Water Furnace - NXW210 or equal)	2	EA	$ 15,570.00	$ 31,140.00	$ 36,330.00	$ 72,660.00	$ 103,800.00
	Subtotal				**$ 31,140.00**		**$ 72,660.00**	**$ 103,800.00**
23 8219	**Fan Coil Units**							
	FCU-1 - 900 CFM, 0.75 HP	1	EA	$ 2,010.00	$ 2,010.00	$ 4,690.00	$ 4,690.00	$ 6,700.00
	FCU-2 - 400 CFM, 0.33 HP	1	EA	$ 1,890.00	$ 1,890.00	$ 4,410.00	$ 4,410.00	$ 6,300.00
	FCU-3 - 3150 CFM, 1.5 HP	1	EA	$ 2,400.00	$ 2,400.00	$ 5,600.00	$ 5,600.00	$ 8,000.00
	FCU-4 - 5023 CFM, 5 HP	1	EA	$ 2,370.00	$ 2,370.00	$ 5,530.00	$ 5,530.00	$ 7,900.00
	FCU-5 - 2898 CFM, 1.5 HP	1	EA	$ 2,250.00	$ 2,250.00	$ 5,250.00	$ 5,250.00	$ 7,500.00
	FCU-6 - 750 CFM, 0.75 HP	1	EA	$ 1,890.00	$ 1,890.00	$ 4,410.00	$ 4,410.00	$ 6,300.00
	Subtotal				**$ 12,810.00**		**$ 29,890.00**	**$ 42,700.00**
23 8236	**Finned-Tube Radiation Heaters**							
	RAD-1 - In Trench - 1703 BTUH	38	ea	$ 1,950.00	$ 74,100.00	$ 4,550.00	$ 172,900.00	$ 247,000.00
	RAD-2 - 3163 BTUH	3	EA	$ 1,750.00	$ 5,250.00	$ 4,083.33	$ 12,250.00	$ 17,500.00
	Subtotal				**$ 79,350.00**		**$ 185,150.00**	**$ 264,500.00**
23 8239.19	**Wall and Ceiling Unit Heaters**							
	Propeller Unit Heaters:							
	Electric Unit Heater- UH-1 - 300 CFM	12	EA	$ 544.50	$ 6,534.00	$ 1,270.50	$ 15,246.00	$ 21,780.00
	Electric Duct Heater EDH-1 - 8KW	1	EA	$ 750.00	$ 750.00	$ 1,750.00	$ 1,750.00	$ 2,500.00
	Electric Unit Heaters UV-1 - 150 CFM		EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Subtotal				**$ 7,284.00**		**$ 16,996.00**	**$ 24,280.00**
23 8316	**Radiant-Heating Hydronic Piping**							
	Radiant Floor system - 1015 SF-8 Loop	1,015	SF	$ 32.10	$ 32,581.00	$ 74.90	$ 76,024.00	$ 108,605.00
	Radiant Floor system - 775 SF6 Loop	775	SF	$ 32.10	$ 24,877.00	$ 74.90	$ 58,048.00	$ 82,925.00
	Radiant Floor Mixing block-for 1015 SF	1	EA	$ 1,170.00	$ 1,170.00	$ 2,730.00	$ 2,730.00	$ 3,900.00
	Radiant Floor Mixing block-for 7755 SF	1	EA	$ 1,170.00	$ 1,170.00	$ 2,730.00	$ 2,730.00	$ 3,900.00

CSI	DESCRIPTION OF WORK		QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
		Subtotal				**$ 59,798.00**		**$ 139,532.00**	**$ 199,330.00**
26 0000	**ELECTRICAL**								
26 0500	**Common Work Results for Electrical**								
	Temp Lighting & Power		1	LS	$ 8,910.00	$ 8,910.00	$ 20,790.00	$ 20,790.00	$ 29,700.00
	Misc Groundings		1	LS	$ 4,455.00	$ 4,455.00	$ 10,395.00	$ 10,395.00	$ 14,850.00
		Subtotal				**$ 13,365.00**		**$ 31,185.00**	**$ 44,550.00**
26 0519	**Low-Voltage Electrical Power Conductors and Cables**								
	Building:								
	Power Feeders								
	#1		1,000	LF	$ 1.09	$ 1,087.00	$ 2.54	$ 2,536.00	$ 3,623.00
	#1/0		1,000	LF	$ 1.27	$ 1,271.00	$ 2.97	$ 2,966.00	$ 4,237.00
	#2		1,000	LF	$ 0.94	$ 944.00	$ 2.20	$ 2,204.00	$ 3,148.00
	#250KCMIL		500	LF	$ 2.19	$ 1,096.00	$ 5.11	$ 2,557.00	$ 3,653.00
	#3		0	LF		$ -		$ -	$ -
	#4		500	LF	$ 0.69	$ 344.00	$ 1.61	$ 804.00	$ 1,148.00
	#4/0		400	LF	$ 0.49	$ 195.00	$ 1.14	$ 454.00	$ 649.00
	#500KCMIL		3,000	LF	$ 3.61	$ 10,834.00	$ 8.43	$ 25,281.00	$ 36,115.00
	#6		2,000	LF	$ 0.56	$ 1,123.00	$ 1.31	$ 2,619.00	$ 3,742.00
	#8		2,000	LF	$ 0.45	$ 897.00	$ 1.05	$ 2,093.00	$ 2,990.00
	Mech Power Feeders								
	#8		500	LF	$ 0.45	$ 224.00	$ 1.05	$ 523.00	$ 747.00
	#10		1,000	LF	$ 0.34	$ 336.00	$ 0.78	$ 783.00	$ 1,119.00
	#12		10,000	LF	$ 0.28	$ 2,792.00	$ 0.65	$ 6,514.00	$ 9,306.00
	Lighting Fixtures wiring / Wiring Devices								
	#12		100,000	LF	$ 0.28	$ 27,918.00	$ 0.65	$ 65,142.00	$ 93,060.00
	Site:								
	AP1		10	EA	$ 647.50	$ 6,475.00	$ 1,510.70	$ 15,107.00	$ 21,582.00
	AP2		12	EA	$ 647.42	$ 7,769.00	$ 1,510.75	$ 18,129.00	$ 25,898.00
	AF5		1	EA	$ 190.00	$ 190.00	$ 444.00	$ 444.00	$ 634.00
	AG1		4	EA	$ 190.00	$ 760.00	$ 443.50	$ 1,774.00	$ 2,534.00
	AG4		65	EA	$ 190.08	$ 12,355.00	$ 443.52	$ 28,829.00	$ 41,184.00
	AG2		4	EA	$ 314.75	$ 1,259.00	$ 734.75	$ 2,939.00	$ 4,198.00
	AF1		11	EA	$ 231.64	$ 2,548.00	$ 540.55	$ 5,946.00	$ 8,494.00
	AW2-E		76	EA	$ 231.66	$ 17,606.00	$ 540.54	$ 41,081.00	$ 58,687.00
	AL7 w/ LED Driver		250	LF	$ 13.36	$ 3,341.00	$ 31.18	$ 7,796.00	$ 11,137.00
	1" PVC		1,000	LF	$ 3.15	$ 3,148.00	$ 7.35	$ 7,346.00	$ 10,494.00
	#8		2,000	LF	$ 0.45	$ 897.00	$ 1.05	$ 2,093.00	$ 2,990.00
	#10		2,000	LF	$ 0.34	$ 671.00	$ 0.78	$ 1,566.00	$ 2,237.00
	Excavation & Backfilling			With Site		$ -		$ -	
	Light Pole foundations and groundings			With Site		$ -		$ -	$ -
		Subtotal				**$ 106,080.00**		**$ 247,526.00**	**$ 353,606.00**

CSI #	DESCRIPTION OF WORK	QNTY	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
26 0523	**Control- Voltage Eletrical Power Cables**							
	Motorized Gate (1hp) to MP1 (1" 5#10) 1" RGS	370	LF	$ 11.29	$ 4,176.00	$ 26.33	$ 9,743.00	$ 13,919.00
	#10	1,116	LF	$ 11.29	$ 12,595.00	$ 26.33	$ 29,389.00	$ 41,984.00
	Solenoid Valve to PP1 (1" 3#10)							
	1" RGS	370	LF	$ 11.29	$ 4,176.00	$ 26.33	$ 9,743.00	$ 13,919.00
	#10	1,116	LF	$ 11.29	$ 12,595.00	$ 26.33	$ 29,389.00	$ 41,984.00
	Cell #6 Fountain to PP1 (1" 5#10)							
	1" RGS	373	LF	$ 11.29	$ 4,210.00	$ 26.33	$ 9,822.00	$ 14,032.00
	#10	1,865	LF	$ 11.29	$ 21,048.00	$ 26.33	$ 49,113.00	$ 70,161.00
	Signage to PP1 (1" 3#10)							
	1" RGS	141	LF	$ 11.28	$ 1,591.00	$ 26.33	$ 3,713.00	$ 5,304.00
	#10	423	LF	$ 11.29	$ 4,774.00	$ 26.33	$ 11,139.00	$ 15,913.00
	Control unit to PP1 (1" 2#10, #8)							
	1" RGS	144	LF	$ 11.28	$ 1,625.00	$ 26.33	$ 3,792.00	$ 5,417.00
	#10	288	LF	$ 11.28	$ 3,250.00	$ 26.34	$ 7,585.00	$ 10,835.00
	#8	144	LF	$ 11.28	$ 1,625.00	$ 26.33	$ 3,792.00	$ 5,417.00
	Control unit to PP1 (1" 2#10, #8)							
	1" RGS	153	LF	$ 11.29	$ 1,727.00	$ 26.33	$ 4,029.00	$ 5,756.00
	#10	306	LF	$ 11.29	$ 3,454.00	$ 26.33	$ 8,058.00	$ 11,512.00
	#8	153	LF	$ 11.29	$ 1,727.00	$ 26.33	$ 4,029.00	$ 5,756.00
	Signage to PP1 (1" 3#10)							
	1" RGS	105	LF	$ 11.29	$ 1,185.00	$ 26.33	$ 2,765.00	$ 3,950.00
	#10	315	LF	$ 11.29	$ 3,555.00	$ 26.33	$ 8,295.00	$ 11,850.00
	Excavation & Backfilling		With Site		$ -		$ -	$ -
	Concrete		With Site		$ -		$ -	$ -
	Subtotal				**$ 83,313.00**		**$ 194,396.00**	**$ 277,709.00**
26 0526	**Grounding and Bonding for Electrical Systems (included w/ other Division 26 sections)**							
26 0529	**Hangers and Supports for Electrical Systems (included w/ section 260519 and 265100)**							
26 0533	**Raceways and Boxes for Electrical Systems**							
	Conduits for Power Feeders							
	1-1/2"EMT	250	LF	$ 4.75	$ 1,188.00	$ 11.09	$ 2,772.00	$ 3,960.00
	2"EMT	200	LF	$ 9.06	$ 1,812.00	$ 21.14	$ 4,227.00	$ 6,039.00
	2-1/2"EMT	30	LF	$ 11.43	$ 343.00	$ 26.67	$ 800.00	$ 1,143.00
	3"EMT	40	LF	$ 13.95	$ 558.00	$ 32.58	$ 1,303.00	$ 1,861.00
	4"EMT	120	LF	$ 18.71	$ 2,245.00	$ 43.66	$ 5,239.00	$ 7,484.00
	Conduits for Mech Feeders							
	3/4"EMT	2,000	LF	$ 31.36	$ 62,726.00	$ 73.18	$ 146,362.00	$ 209,088.00
	3/4" (5 LF Flex, Str. 90 Degreee Conn.)	50	EA	$ 98.00	$ 4,900.00	$ 228.70	$ 11,435.00	$ 16,335.00
	Conduits for Lighting Fixtures and wiring Devices 3/4" EMT	3,000	LF	$ 31.36	$ 94,090.00	$ 73.18	$ 219,542.00	$ 313,632.00
	3/4" RGS	2,000	LF	$ 42.32	$ 84,645.00	$ 98.75	$ 197,505.00	$ 282,150.00
	Junction Boxes:							
	Junction Boxes (Signage)	10	EA	$ 7.60	$ 76.00	$ 17.60	$ 176.00	$ 252.00
	Junction Boxes (Lighting, Wiring Devces)	20	EA	$ 7.55	$ 151.00	$ 17.70	$ 354.00	$ 505.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QNTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL LABOR
	Subtotal				$ 252,734.00		$ 589,715.00	$ 842,449.00
26 0543	**Underground Ducts and Raceways for Electrical Systems**							
	SITE POWER WORK							
	Con Edison XFMER TO MDP (3 SETS (4" 4#500KCM #2/0)							
	4"PVC	200	LF	$ 13.96	$ 2,792.00	$ 32.57	$ 6,514.00	$ 9,306.00
	#500KCM	800	LF	$ 3.61	$ 2,889.00	$ 8.43	$ 6,742.00	$ 9,631.00
	#2/0	200	LF	$ 1.39	$ 278.00	$ 3.25	$ 649.00	$ 927.00
	Con Edison XFMER TO MDP (3 SETS (3" 3#400KCM #2/0) (INSIDE bldg)							
	4"RGS	200	LF	$ 26.73	$ 5,346.00	$ 62.37	$ 12,474.00	$ 17,820.00
	#500KCM	800	LF	$ 3.61	$ 2,889.00	$ 8.43	$ 6,742.00	$ 9,631.00
	#2/0	200	LF	$ 1.39	$ 278.00	$ 3.25	$ 649.00	$ 927.00
	Subtotal				$ 14,472.00		$ 33,770.00	$ 48,242.00
26 0544	**Sleeves and Sleeve Seals for Electrical Raceways**							
	Sleeves and Sleeve Seals for Electrical Raceways and Cabling	10	LF	$ 56.40	$ 564.00	$ 131.70	$ 1,317.00	$ 1,881.00
	Subtotal				$ 564.00		$ 1,317.00	$ 1,881.00
26 0548	**Vibration and Seismic Controls for Electrical Systems**							
	Vibration and Seismic Controls for Electrical Systems	1	LS	$ 2,150.00	$ 2,150.00	$ 5,018.00	$ 5,018.00	$ 7,168.00
	Subtotal				$ 2,150.00		$ 5,018.00	$ 7,168.00
26 0553	**Identification for Eletrical Systems (included w/ section 262416)**							
26 0573	**Overcurrent Protective Device Coordination Study (included w/ other Division 26 sections)**							
26 0923	**Lighting Control Devices**							
	Dimmer Switch	0	EA		$ -		$ -	$ -
	Occupancy Sensor - Switch	2	EA	$ 157.50	$ 315.00	$ 367.00	$ 734.00	$ 1,049.00
	Occupancy Sensor	2	EA	$ 157.50	$ 315.00	$ 367.00	$ 734.00	$ 1,049.00
	3 way Switch	6	EA	$ 31.17	$ 187.00	$ 72.83	$ 437.00	$ 624.00
	Switch	24	EA	$ 28.21	$ 677.00	$ 65.83	$ 1,580.00	$ 2,257.00
	18/3 LV Cables w/ outlet box	2	EA	$ 26.50	$ 53.00	$ 62.50	$ 125.00	$ 178.00
	Subtotal				$ 1,547.00		$ 3,610.00	$ 5,157.00
26 0943.23	**Relay Based Lighting Controls (included w/ other Division 26 sections)**							
26 2200	**Low-Voltage Tranformers**							
	5 KVA XFMER 480V-208/120V	1	EA	$ 226.00	$ 226.00	$ 526.00	$ 526.00	$ 752.00
	45 KVA XFMER - 480V-208/120V	2	EA	$ 1,223.50	$ 2,447.00	$ 2,855.50	$ 5,711.00	$ 8,158.00
	75 KVA XFMER - 480V208/120V	3	EA	$ 2,150.33	$ 6,451.00	$ 5,017.33	$ 15,052.00	$ 21,503.00
	Subtotal				$ 9,124.00		$ 21,289.00	$ 30,413.00

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QTY	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
26 2413	**Switchboards**							
	MDP (1000a 480/277V 3PH) w/ 1000A Disconnect Switch and TVSS w/ CT Metering	1	EA	$ 6,558.00	$ 6,558.00	$ 15,301.00	$ 15,301.00	$ 21,859.00
	Subtotal				**$ 6,558.00**		**$ 15,301.00**	**$ 21,859.00**
26 2416	**Panel Boards**							
	200A Disconnect Switch	2	EA	$ 451.50	$ 903.00	$ 1,053.50	$ 2,107.00	$ 3,010.00
	12KW-INVERTER	1	EA	$ 1,241.00	$ 1,241.00	$ 2,897.00	$ 2,897.00	$ 4,138.00
	100A 480/277 42P	3	EA	$ 730.67	$ 2,192.00	$ 1,704.67	$ 5,114.00	$ 7,306.00
	100A 208/120 42P	2	EA	$ 730.50	$ 1,461.00	$ 1,705.00	$ 3,410.00	$ 4,871.00
	225A 480/277 54P	0	EA		$ -		$ -	$ -
	225A 208/120 42P	3	EA	$ 1,592.00	$ 4,776.00	$ 3,714.33	$ 11,143.00	$ 15,919.00
	250A 208/120E 68P	0	EA		$ -		$ -	$ -
	400A - 480/277V -30P	1	EA	$ 2,352.00	$ 2,352.00	$ 5,489.00	$ 5,489.00	$ 7,841.00
	400A 480/277 42P	1	EA	$ 2,352.00	$ 2,352.00	$ 5,489.00	$ 5,489.00	$ 7,841.00
	400A 480/277 54P	1	EA	$ 2,352.00	$ 2,352.00	$ 5,489.00	$ 5,489.00	$ 7,841.00
	100A 480/277 12P	1	EA	$ 730.00	$ 730.00	$ 1,705.00	$ 1,705.00	$ 2,435.00
	60A 208/120 28P	0	EA		$ -		$ -	$ -
	A60208/P12030	0	EA		$ -		$ -	$ -
	Digital sub Meter	1	EA	$ 463.00	$ 463.00	$ 1,081.00	$ 1,081.00	$ 1,544.00
	Subtotal				**$ 18,822.00**		**$ 43,924.00**	**$ 62,746.00**
26 2726	**Wiring Devices**							
	Duplex Receptacle	82	EA	$ 47.52	$ 3,897.00	$ 110.88	$ 9,092.00	$ 12,989.00
	Double Duplex Receptacle	16	EA	$ 49.00	$ 784.00	$ 114.38	$ 1,830.00	$ 2,614.00
	Double Duplex Receptacle-Ceiling Mtd	8	EA	$ 47.50	$ 380.00	$ 110.88	$ 887.00	$ 1,267.00
	Duplex Receptacle-GFI	22	EA	$ 56.41	$ 1,241.00	$ 131.68	$ 2,897.00	$ 4,138.00
	Double Duplex Receptcle-GFI	6	EA	$ 60.83	$ 365.00	$ 142.17	$ 853.00	$ 1,218.00
	Duplex Receptacle-GFI-WP	6	EA	$ 60.83	$ 365.00	$ 142.17	$ 853.00	$ 1,218.00
	Double Duplex Receptacle-Floor Mtd-wp	4	EA	$ 71.25	$ 285.00	$ 166.25	$ 665.00	$ 950.00
	Junction Boxes	12	EA	$ 28.25	$ 339.00	$ 65.83	$ 790.00	$ 1,129.00
	Subtotal				**$ 7,656.00**		**$ 17,867.00**	**$ 25,523.00**
26 2813	**Fuses (included w/ section 262816)**							
26 2816	**Enclosed Switches and Circuit Breakers**							
	Fused Disconnect Switch - 60A	12	EA	$ 285.08	$ 3,421.00	$ 665.33	$ 7,984.00	$ 11,405.00
	Fused Disconnect Switch - 30A	24	EA	$ 157.42	$ 3,778.00	$ 367.29	$ 8,815.00	$ 12,593.00
	Fused Disconnect Switch-WP - 30A	4	EA	$ 187.00	$ 748.00	$ 436.75	$ 1,747.00	$ 2,495.00
	Unfused Disconnect Switch - 30A	24	EA	$ 127.71	$ 3,065.00	$ 298.00	$ 7,152.00	$ 10,217.00
	3 way Switch	12	EA	$ 28.25	$ 339.00	$ 65.83	$ 790.00	$ 1,129.00
	Switch	12	EA	$ 26.75	$ 321.00	$ 62.33	$ 748.00	$ 1,069.00
	Subtotal				**$ 11,672.00**		**$ 27,236.00**	**$ 38,908.00**
26 2913	**Enclosed Controllers**							
	Magnetic Motor Starter	4	EA	$ -	$ -	$ 990.00	$ 3,960.00	$ 3,960.00
	Subtotal				**$ -**		**$ 3,960.00**	**$ 3,960.00**

CSI	DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL & LABOR
26 2923	**Variable-Frequency Motor Controllers**							
	Building:							
	1.5HP VFD (Connect, Mount & Receive)	4	EA	$ 166.25	$ 665.00	$ 388.25	$ 1,553.00	$ 2,218.00
	2HP VFD (Connect, Mount & Receive)	2	EA	$ 208.00	$ 416.00	$ 485.00	$ 970.00	$ 1,386.00
	3HP VFD (Connect, Mount & Receive)	2	EA	$ 332.50	$ 665.00	$ 776.50	$ 1,553.00	$ 2,218.00
	5HP VFD (Connect, Mount & Receive)	2	EA	$ 499.00	$ 998.00	$ 1,164.00	$ 2,328.00	$ 3,326.00
	7.5HP VFD (Connect, Mount & Receive)	2	EA	$ 665.00	$ 1,330.00	$ 1,552.50	$ 3,105.00	$ 4,435.00
	15HP VFD (Connect, Mount & Receive)	2	EA	$ 998.00	$ 1,996.00	$ 2,328.50	$ 4,657.00	$ 6,653.00
	Fused Disconnect Switch - 60A	1	EA	$ 1,141.00	$ 1,141.00	$ 2,661.00	$ 2,661.00	$ 3,802.00
	Fused Disconnect Switch - 30A	3	EA	$ 157.33	$ 472.00	$ 367.33	$ 1,102.00	$ 1,574.00
	Fused Disconnect Switch-WP - 30A	1	EA	$ 748.00	$ 748.00	$ 1,747.00	$ 1,747.00	$ 2,495.00
	Unfused Disconnect Switch - 30A	3	EA	$ 127.67	$ 383.00	$ 298.00	$ 894.00	$ 1,277.00
	Magnetic Motor Starter	1	EA	$ 451.00	$ 451.00	$ 1,054.00	$ 1,054.00	$ 1,505.00
	Toggle Switch	1	EA	$ 142.00	$ 142.00	$ 333.00	$ 333.00	$ 475.00
	Junction box (Signage)	1	EA	$ 96.00	$ 96.00	$ 225.00	$ 225.00	$ 321.00
	Site:							
	SITE MECH EQUIPMENTS DISCONNECTS							
	Unfused Disconnect Switch WP-30A	2	EA	$ 179.50	$ 359.00	$ 419.50	$ 839.00	$ 1,198.00
	Junction Box - WP	8	EA	$ 56.38	$ 451.00	$ 131.75	$ 1,054.00	$ 1,505.00
	Subtotal				**$ 10,313.00**		**$ 24,075.00**	**$ 34,388.00**
26 3323	**Central Battery Equipment (included w/ other Division 26 Sections)**							
26 5100	**Lighting Fixtures and Devices**							
	AD1	18	EA	$ 249.50	$ 4,491.00	$ 582.11	$ 10,478.00	$ 14,969.00
	AD2-E	29	EA	$ 249.48	$ 7,235.00	$ 582.10	$ 16,881.00	$ 24,116.00
	AD3	9	EA	$ 249.44	$ 2,245.00	$ 582.11	$ 5,239.00	$ 7,484.00
	AD3-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AD4	3	EA	$ 249.33	$ 748.00	$ 582.33	$ 1,747.00	$ 2,495.00
	AD4-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AD5	4	EA	$ 249.50	$ 998.00	$ 582.00	$ 2,328.00	$ 3,326.00
	AD8	5	EA	$ 249.40	$ 1,247.00	$ 582.20	$ 2,911.00	$ 4,158.00
	AD8-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AF3	67	EA	$ 249.48	$ 16,715.00	$ 582.12	$ 39,002.00	$ 55,717.00
	AF8	2	EA	$ 249.50	$ 499.00	$ 582.00	$ 1,164.00	$ 1,663.00
	AF9	9	EA	$ 249.44	$ 2,245.00	$ 582.11	$ 5,239.00	$ 7,484.00
	AG3-E	19	EA	$ 249.47	$ 4,740.00	$ 582.11	$ 11,060.00	$ 15,800.00
	AL1	40	EA	$ 249.48	$ 9,979.00	$ 582.13	$ 23,285.00	$ 33,264.00
	AL1-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AL2	12	EA	$ 249.50	$ 2,994.00	$ 582.08	$ 6,985.00	$ 9,979.00
	AL2-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AL3	9	EA	$ 249.44	$ 2,245.00	$ 582.11	$ 5,239.00	$ 7,484.00
	AL3-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AL4	32	EA	$ 249.47	$ 7,983.00	$ 582.13	$ 18,628.00	$ 26,611.00
	AL9	16	EA	$ 249.50	$ 3,992.00	$ 582.13	$ 9,314.00	$ 13,306.00
	AL-4	32	EA	$ 249.47	$ 7,983.00	$ 582.13	$ 18,628.00	$ 26,611.00

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

	DESCRIPTION OF WORK	QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	AL-8 w/ Battery Back up	25	EA	$ 249.48	$ 6,237.00	$ 582.12	$ 14,553.00	$ 20,790.00
	AM1	18	EA	$ 249.50	$ 4,491.00	$ 582.11	$ 10,478.00	$ 14,969.00
	AM1-E	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	AR1	4	EA	$ 291.00	$ 1,164.00	$ 679.25	$ 2,717.00	$ 3,881.00
	AW-2E	76	EA	$ 249.49	$ 18,961.00	$ 582.12	$ 44,241.00	$ 63,202.00
	AW-3E	71	EA	$ 249.48	$ 17,713.00	$ 582.13	$ 41,331.00	$ 59,044.00
	EX	24	EA	$ 71.29	$ 1,711.00	$ 166.29	$ 3,991.00	$ 5,702.00
	LF-1	66	EA	$ 249.48	$ 16,466.00	$ 582.12	$ 38,420.00	$ 54,886.00
	LF-1E w/ Battery Back up	45	EA	$ 249.49	$ 11,227.00	$ 582.11	$ 26,195.00	$ 37,422.00
	LIGHTING for Tee Boxes	0						
	AD6	32	EA	$ 249.47	$ 7,983.00	$ 582.13	$ 18,628.00	$ 26,611.00
	AD7	62	EA	$ 249.48	$ 15,468.00	$ 582.11	$ 36,091.00	$ 51,559.00
	AF4	12	EA	$ 249.50	$ 2,994.00	$ 582.08	$ 6,985.00	$ 9,979.00
	AL-5	62	EA	$ 249.48	$ 15,468.00	$ 582.11	$ 36,091.00	$ 51,559.00
	AL-6	62	EA	$ 249.48	$ 15,468.00	$ 582.11	$ 36,091.00	$ 51,559.00
	Subtotal				**$ 211,690.00**		**$ 493,940.00**	**$ 705,630.00**
28 0000	**ELECTRONIC SAFETY & SECURITY**							
28 3100	**Digital, Addressable Fire-Alarm System**							
	TELECOMMUNICATION SYSTEM							
	MDF/IDF	1	LS	$ 315.00	$ 315.00	$ 734.00	$ 734.00	$ 1,049.00
	Tel/Data	12	EA	$ 56.42	$ 677.00	$ 131.67	$ 1,580.00	$ 2,257.00
	Cat 6	100	LF	$ 4.18	$ 418.00	$ 9.76	$ 976.00	$ 1,394.00
	FIRE ALARM SYSTEM							
	FACP w/ Battery back-up	1	EA	$ 1,093.00	$ 1,093.00	$ 2,550.00	$ 2,550.00	$ 3,643.00
	Remote Annuciator Panel	1	EA	$ 630.00	$ 630.00	$ 1,469.00	$ 1,469.00	$ 2,099.00
	FDS (Fused Disconnect S/W)	2	EA	$ 225.50	$ 451.00	$ 527.00	$ 1,054.00	$ 1,505.00
	Speaker/Strobe-Wall Mtd	40	EA	$ 56.43	$ 2,257.00	$ 131.68	$ 5,267.00	$ 7,524.00
	Stobe	3	EA	$ 56.33	$ 169.00	$ 131.67	$ 395.00	$ 564.00
	Smoke Detector	22	EA	$ 56.41	$ 1,241.00	$ 131.68	$ 2,897.00	$ 4,138.00
	Smoke Detector - Duct Mtd	8	EA	$ 56.38	$ 451.00	$ 131.75	$ 1,054.00	$ 1,505.00
	Pull Station	6	EA	$ 56.50	$ 339.00	$ 131.67	$ 790.00	$ 1,129.00
	Flow Switch (Connection Only)	4	EA	$ 56.50	$ 226.00	$ 131.50	$ 526.00	$ 752.00
	Tamper Switch (Connection Only)	10	EA	$ 56.40	$ 564.00	$ 131.70	$ 1,317.00	$ 1,881.00
	Pressure Switch	1	EA	$ 56.00	$ 56.00	$ 132.00	$ 132.00	$ 188.00
	Fire Smoke Demper Connection	17	EA	$ 56.41	$ 959.00	$ 131.71	$ 2,239.00	$ 3,198.00
	Relay	4	EA	$ 56.50	$ 226.00	$ 131.50	$ 526.00	$ 752.00
	Speaker/Strobe-Wall Mtd-WP	3	EA	$ 56.33	$ 169.00	$ 131.67	$ 395.00	$ 564.00
	Pull Station-TR	0	EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Pull Station-TR-WP	1	EA	$ 56.00	$ 56.00	$ 132.00	$ 132.00	$ 188.00
	FACP to Remote Annuciator.	50	LF	$ 41.60	$ 2,080.00	$ 97.08	$ 4,854.00	$ 6,934.00
	Panel to FACP, RAN (3/4" 3#10)			#DIV/0!	$ -	#DIV/0!	$ -	$ -
	3/4"EMT	100	LF	$ 31.20	$ 3,120.00	$ 72.81	$ 7,281.00	$ 10,401.00
	#10	300	LF	$ 2.95	$ 886.00	$ 6.90	$ 2,069.00	$ 2,955.00
	Provide (2) Dedicated Telephone Line to Dial to Central Monitoring station	2	EA	$ 225.50	$ 451.00	$ 527.00	$ 1,054.00	$ 1,505.00

CSI	Description of Work	QUANTITY	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	3/4" RGS	100	LF	$ 41.61	$ 4,161.00	$ 97.09	$ 9,709.00	$ 13,870.00
	Teflon cables	4,000	LF	$ 2.93	$ 11,725.00	$ 6.84	$ 27,360.00	$ 39,085.00
	System testing & Commissioning	1	LS	$ 102,972.00	$ 102,972.00	$ 240,269.00	$ 240,269.00	$ 343,241.00
	Subtotal				**$ 135,692.00**		**$ 316,629.00**	**$ 452,321.00**
31 0000	**EARTHWORK**							
31 1000	**Site Clearing**							
	Clearing & Grubbing	35,070	SF	$ 2.20	$ 77,224.00	$ 5.14	$ 180,190.00	$ 257,414.00
	Topsoil stripping and stockpiling, topsoil, clay, medium hard, adverse conditions, 300 H.P. dozer	1	ls	$ 23,335.00	$ 23,335.00	$ 54,447.00	$ 54,447.00	$ 77,782.00
	Subtotal				**$ 100,559.00**		**$ 234,637.00**	**$ 335,196.00**
31 2000	**Earthwork**							
	Building:							
	Excavation and backfill and haul away - TB (Assume 4,200 CY)	4,200	CY	$ 22.39	$ 94,055.00	$ 52.25	$ 219,461.00	$ 313,516.00
	Select fill under stair	2	CY	$ 550.50	$ 1,101.00	$ 1,284.50	$ 2,569.00	$ 3,670.00
	Excavation and Fill:							
	Excavation and backfill for Clubhouse foundation (Assume 14,000 CY)	14,000	CY	$ 34.14	$ 477,898.00	$ 79.65	$ 1,115,096.00	$ 1,592,994.00
	Site:							
	Final Grading	195,548	SF	$ 1.32	$ 258,268.00	$ 3.08	$ 602,626.00	$ 860,894.00
	Excavation, Backfill for Gabion Wall (Assume 3,900 CY)	3,900	CY	$ -	$ -	$ -	$ -	$ -
	Excavation, Backfill in Phase A (Assume 5,064 CY)	5,064	CY	$ -	$ -	$ -	$ -	$ -
	Excavation and haul away in Phase A CW (Assume 6,800 CY)	6,800	CY	$ -	$ -	$ -	$ -	$ -
	Excavation, Backfill or haul away at CW 6&7 (Assume 5,547 CY)	5,547	CY	$ -	$ -	$ -	$ -	$ -
	6" th. Aggregate Fill At Cell 6 & 7		SF	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Excavation and backfill or haul away - FOR IRRIGATION PIPING		CY	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Excavation and backfill or haul away - FOR ELECTRICAL CONDUITS & WIRES	2,223	CY	$ 78.73	$ 175,008.00	$ 183.69	$ 408,353.00	$ 583,361.00
	Select fill at the end of cell 7		CY	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Backfill, structural, sandy clay & loam, 105 H.P. dozer, 300' haul - permeable pavement		CY	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Compaction, structural, 5 tons, steel wheel tandem roller - permeable pavement		HR	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Relocate Exisitng Boulders		EA	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Subtotal				**$ 1,006,330.00**		**$ 2,348,105.00**	**$ 3,354,435.00**
31 2316	**Rock Removal**							
	Remove Existing Boulders	41	EA	$ 68.63	$ 2,814.00	$ 160.17	$ 6,567.00	$ 9,381.00
	Rock excavation at Cell 5 including footing excavation (Assume 900 CY)	900	CY	$ 73.63	$ 66,271.00	$ 171.82	$ 154,634.00	$ 220,905.00
	Subtotal				**$ 69,085.00**		**$ 161,201.00**	**$ 230,286.00**
31 2319	**Dewatering**							
	Dewatering	1	LS	$ 12,478.00	$ 12,478.00	$ 112,302.00	$ 112,302.00	$ 124,780.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK		QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
		Subtotal				**$ 12,478.00**		**$ 112,302.00**	**$ 124,780.00**
31 2500	**Erosion and Sedimentation Controls**								
	Temporary Sediment Control Swale		4,125	LF	$ 5.04	$ 20,809.00	$ 11.77	$ 48,554.00	$ 69,363.00
	Silt Fence		4,605	LF	$ 3.23	$ 14,877.00	$ 7.54	$ 34,714.00	$ 49,591.00
	Temporary Sediment Control Swale		Included as Shown			$ -		$ -	$ -
	Silt Fence		Included as Shown			$ -		$ -	$ -
	Sediment Basin #1								
	Stone check dam, 10' x 4.5'		53	EA	$ 526.36	$ 27,897.00	$ 1,228.15	$ 65,092.00	$ 92,989.00
		Subtotal				**$ 63,583.00**		**$ 148,360.00**	**$ 211,943.00**
31 3219	**Geo Synthetic Soil Stabilization & Layer Separation**								
	Geosynthetic clay liner		90,237	SF	$ 0.37	$ 33,779.00	$ 0.87	$ 78,818.00	$ 112,597.00
		Subtotal				**$ 33,779.00**		**$ 78,818.00**	**$ 112,597.00**
31 5000	**Excavation Support and Protection**								
	Building:								
	Excavation Support and Protection		Included as Needed			$ -		$ -	$ -
	Site:								
	Excavation Support and Protection for Gabion Wall		Included as Needed			$ -		$ -	$ -
		Subtotal				**$ -**		**$ -**	**$ -**
32 0000	**EXTERIOR IMPROVEMENTS**								
32 0516	**Aggregate Paving**								
	8' Wide Gravel Maintenance Path 6" + 3" (excluding aggregate)		567	SF	$ 12.43	$ 7,046.00	$ 29.00	$ 16,442.00	$ 23,488.00
		Subtotal				**$ 7,046.00**		**$ 16,442.00**	**$ 23,488.00**
32 1216	**Bituminous Pavement**								
	Plant-mix asphalt paving, for highways and large paved areas, binder course, 1-1/2" thick		4,500	SY	$ 47.80	$ 215,104.00	$ 111.54	$ 501,911.00	$ 717,015.00
		Subtotal				**$ 215,104.00**		**$ 501,911.00**	**$ 717,015.00**
32 1217	**Aggregate Overlay over Asphalt**								
	Building:								
	3/32"-3/16" Aggregate overlay asphalt (material cost for Aggregate)		48	CY	[redacted]		$ 8,834.54	$ 424,058.00	$ 424,058.00
	Site:								
	Aggregate Subbase - under 6" pavement		Included as Shown			$ -		$ -	$ -
	Aggregate Subbase - under 12" roadway pavement		Included as Shown			$ -		$ -	$ -
	Aggregate Subbase - under 12" plank pavement		Included as Shown			$ -		$ -	$ -
	11' Wide Asphalt Pving for Golf Cart & Pedestrian 1.5"+ 3" w/ 6" Aggregate		11,248	SF	$ 4.42	$ 49,680.00	$ 10.31	$ 115,919.00	$ 165,599.00
		Subtotal				**$ 49,680.00**		**$ 539,977.00**	**$ 589,657.00**
32 1313	**Concrete Paving**								
	Building:								

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI No.	Description of Work	Quantity	Unit of Meas.	Material Unit Cost	Material Total	Labor Unit Cost	Labor Total	Total Cost Material & Labor
	Geofoam mound at roof	208	CY	$ 621.43	$ 129,350.00	$ 414.29	$ 86,233.00	$ 215,583.00
	3/8" Aggregate in concrete paving (material cost for Aggregate)	3	CY			$ 5,732.76	$ 16,625.00	$ 16,625.00
	Site:							
	6" DP CIP Concrete Plank Paving W/ 6" Wide Pervious Concrete Joint (without aggregate)	27,695	SF	$ 20.84	$ 577,219.00	$ 48.63	$ 1,346,845.00	$ 1,924,064.00
	12" DP CIP Concrete Plank Paving with Exposed Aggregate W/ 6" WD (excluding aggregate)	4,305	SF	$ 22.02	$ 94,796.00	$ 51.38	$ 221,191.00	$ 315,987.00
	Subtotal				**$ 801,365.00**		**$ 1,670,894.00**	**$ 2,472,259.00**
32 1314	**Cast in Place Concrete Paving - Pervious**							
	Cast in Place Concrete Paving - Pervious		SF	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	Subtotal				**$ -**		**$ -**	**$ -**
32 1400	**Unit Pavers**							
	Precast concrete unit paving slabs, patio block, colors, 8" x 16", 2-3/8" thick		NIC		$ -		$ -	$ -
	Subtotal				**$ -**		**$ -**	**$ -**
32 1613	**Concrete Curbs and Gutters**							
	Cast-in-place concrete curbs & gutters, radius, machine formed, 6" high curb, 6" thick gutter, 30" wide	2,380	LF	$ 57.05	$ 135,780.00	$ 133.12	$ 316,819.00	$ 452,599.00
	Vehicular Curb Cut, concrete rebar, wood forms,	2	EA	$ 286.00	$ 572.00	$ 668.00	$ 1,336.00	$ 1,908.00
	Pedestrian Curb Cut, concrete, rebar, wood forms,	8	EA	$ 357.88	$ 2,863.00	$ 834.88	$ 6,679.00	$ 9,542.00
	Metal parking bumpers, pipe bollards, conc filled/painted, 8' L x 4' D hole, 8" diam.	2	EA	$ 660.50	$ 1,321.00	$ 1,541.50	$ 3,083.00	$ 4,404.00
	Painted pavement markings, parking space	139	EA	$ 56.08	$ 7,795.00	$ 130.86	$ 18,189.00	$ 25,984.00
	Painted pavement markings, HC sparking space	4	EA	$ 440.50	$ 1,762.00	$ 1,027.50	$ 4,110.00	$ 5,872.00
	2' Wide Thermoplastic Striping Stop Bar	3	EA	$ 440.33	$ 1,321.00	$ 1,027.67	$ 3,083.00	$ 4,404.00
	Subtotal				**$ 151,414.00**		**$ 353,299.00**	**$ 504,713.00**
32 7200	**Plantings for Wetland Areas**							
	Herbaceous Floodplain	8,919	EA	$ 6.61	$ 58,919.00	$ 15.41	$ 137,477.00	$ 196,396.00
	Emergant Herbaceous	2,861	EA	$ 22.02	$ 62,999.00	$ 51.38	$ 146,998.00	$ 209,997.00
	Floating aquatic plants	39	EA	$ 286.26	$ 11,164.00	$ 667.95	$ 26,050.00	$ 37,214.00
	Subtotal				**$ 133,082.00**		**$ 310,525.00**	**$ 443,607.00**
32 7300	**Coir Fiber Blankets**							
	Coir fiber blanket on Top of All Wetland Cell Soil	33,095	SF	$ 0.93	$ 30,828.00	$ 2.17	$ 71,932.00	$ 102,760.00
	Subtotal				**$ 30,828.00**		**$ 71,932.00**	**$ 102,760.00**
32 7400	**Waterfowl Exclusion Barrier**							
	Waterfowl Exclusion Barrier	1	LS	$ 12,278.00	$ 12,278.00	$ 28,650.00	$ 28,650.00	$ 40,928.00
	Subtotal				**$ 12,278.00**		**$ 28,650.00**	**$ 40,928.00**
32 7500	**Soil Mixes for Wetland Areas**							
	Amended top soil	10,310	CY	$ 53.23	$ 548,756.00	$ 124.19	$ 1,280,431.00	$ 1,829,187.00
	Soil Mix 3: Aquatic Soil Mix for Wetland Cells 1 to 5	1,713	CY	$ 52.84	$ 90,523.00	$ 123.30	$ 211,220.00	$ 301,743.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

	Description of Work		QTY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
		Subtotal			**$ 639,279.00**			**$ 1,491,651.00**	**$ 2,130,930.00**
32 8000	**Irrigation System**								
	Building:								
	4" HDPE main line pipe		5,190	LF	$ 18.26	$ 94,783.00	$ 42.61	$ 221,160.00	$ 315,943.00
	8" HDPE main line pipe		3,102	LF	$ 26.49	$ 82,165.00	$ 61.81	$ 191,720.00	$ 273,885.00
	Wire in PVC 1" conduit		5,190	LF	$ 3.50	$ 18,180.00	$ 8.17	$ 42,419.00	$ 60,599.00
	Wire in PVC 1 1/2" conduit		6,204	LF	$ 6.61	$ 40,984.00	$ 15.41	$ 95,628.00	$ 136,612.00
	4" gate valve		Included as Shown			$ -		$ -	$ -
	Air release valve		1	EA	$ -	$ -	$ -	$ -	$ -
	Hydrant		1	EA	$ -	$ -	$ -	$ -	$ -
	Quick coupling valve/hose bib		68	EA	$ -	$ -	$ -	$ -	$ -
	PVC schedule 40 sleeve different size		642	LF	$ 22.02	$ 14,137.00	$ 51.38	$ 32,986.00	$ 47,123.00
	1" - 1 1/2" Poly, 2"-2 1/2" PVC pipe		0	LF	#DIV/0!	$ 11,891.00	#DIV/0!	$ 27,745.00	$ 39,636.00
	1-1/4" HDPE main line pipe (green roof)		0	LF	#DIV/0!	$ -	#DIV/0!	$ -	$ -
	4" HDPE main line pipe		Included as Shown			$ -		$ -	$ -
	8" HDPE main line pipe		Included as Shown			$ -		$ -	$ -
	Sprinkler & sprinkler head including installation		0	EA		$ -		$ -	$ -
	Techline Drip Irrigation		0	SF		$ -		$ -	$ -
	Toro Weather Station		1	EA	$ -	$ -	$ -	$ -	$ -
	Automatic Drip valve, flush valve, coupling valve		0	EA		$ -		$ -	$ -
	4" gate valve		21	EA	$ 352.33	$ 7,399.00	$ 822.05	$ 17,263.00	$ 24,662.00
	8" gate valve		3	EA	$ 660.67	$ 1,982.00	$ 1,541.33	$ 4,624.00	$ 6,606.00
	Wire in PVC 1" conduit			LF		$ -		$ -	$ -
	wire in PVC 1 1/2" conduit			LF		$ -		$ -	$ -
	Site:								
	1"-1 1/2" Poly, 2"-2 1/2" PVC pipe		0	LF		$ -		$ -	$ -
	2" HDPE pipe		0	LF		$ -		$ -	$ -
	Sprinkler & sprinkler head including installation		0	EA		$ -		$ -	$ -
	Automatic Drip valve, flush valve, coupling valve		0	EA		$ -		$ -	$ -
	Wire in PVC 1 1/2" conduit		0	LF		$ -		$ -	$ -
		Subtotal			**$ 271,521.00**			**$ 633,545.00**	**$ 905,066.00**
32 8001	**Irrigation Pump System**								
	Irrigation Pump System								
	Pump control wire in 1 1/2" conduit		Included as Shown			$ -		$ -	$ -
	Irrigation Vertical Pump Station								
	Pump control wire in PVC 1 1/2" conduit		1	ls	$ 55,050.00	$ 55,050.00	$ 128,450.00	$ 128,450.00	$ 183,500.00
	Pump-1A and-1B, Duplex, 500 gpm, 70' hd, 15hp each		1	EA			$ 22,020.00	$ 22,020.00	$ 22,020.00
		Subtotal			**$ 55,050.00**			**$ 150,470.00**	**$ 205,520.00**
32 8002	**Manual Irrigation Scheduling (included w/ other Division 32 sections)**								
32 9113	**Planting Soil Mixes (included w/ other Division 32 sections)**								
32 9300	**Exterior Planting**								

NYC DDC Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORK	QNTY	UNIT MEAS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL LABOR
	Building:							
	Landscape edging	1,687	LF	$ 5.30	$ 8,940.00	$ 12.37	$ 20,860.00	$ 29,800.00
	New 8'ht. x 6'-4" wide security gate	Included as Shown			$ -		$ -	$ -
	New 4'ht. x 3'-7" wide security gate	Included as Shown			$ -		$ -	$ -
	Area 5 Club House Roof (Plugs or 6" pots)	38,360	EA	$ 1.78	$ 68,211.00	$ 4.15	$ 159,160.00	$ 227,371.00
	Landscape edging	Included as Shown			$ -		$ -	$ -
	Site:							
	Herbaceous Floodplain	1,448	EA	$ 110.10	$ 159,425.00	$ 256.90	$ 371,991.00	$ 531,416.00
	Riparian Herbaceous	1,446	EA	$ -	$ -	$ -	$ -	$ -
	Wet Meadow	Included as Shown			$ -		$ -	$ -
	Shallow emergent marsh	12,779	EA	$ 11.01	$ 140,697.00	$ 25.69	$ 328,292.00	$ 468,989.00
	Plants And Planting							
	Area 2 Clubhouse Parking Planting (Turnaround Rockery Planting)	700	sf	$ 1.76	$ 1,233.00	$ 4.11	$ 2,877.00	$ 4,110.00
	Area 3 Clubhouse Parking Planting (Understory Planting At Cultural Tree Woodlot)	61	EA	$ 110.10	$ 6,716.00	$ 256.90	$ 15,671.00	$ 22,387.00
	Area 3 Clubhouse Parking Planting (Turf Types)	Included as Shown			$ -		$ -	$ -
	Tall sun meadow seed mix	73,317	SF	$ 1.54	$ 113,011.00	$ 3.60	$ 263,691.00	$ 376,702.00
	Tall sun meadow seed mix overseeded with wildflower mix	Included as Shown			$ -		$ -	$ -
	Low meadow seed mix	Included as Shown			$ -		$ -	$ -
	Low meadow seed mix overseeded with wildflower mix	Included as Shown			$ -		$ -	$ -
	Tall shade meadow seed mix	55,500	SF	$ 1.54	$ 85,548.00	$ 3.60	$ 199,611.00	$ 285,159.00
	Tall shade meadow seed mix overseeded with wildflower mix	Included as Shown			$ -		$ -	$ -
	Wetland meadow seed mix	Included as Shown			$ -		$ -	$ -
	Proposed Minor Tree (8" HT)	2,800	EA	$ 70.46	$ 197,299.00	$ 164.42	$ 460,365.00	$ 657,664.00
	Proposed Major (4.5" CAL)	5,236	EA	$ 44.04	$ 230,593.00	$ 102.76	$ 538,052.00	$ 768,645.00
	Shrubs (Area 1 Clubhouse Plaza Planting (Plaza 1 and 2 Planting)	3,794	EA	$ 11.01	$ 41,772.00	$ 25.69	$ 97,468.00	$ 139,240.00
	Subtotal				**$ 1,053,445.00**		**$ 2,458,038.00**	**$ 3,511,483.00**
32 9301	**Tree Protection**							
	Temporary Tree Protection (GROUP)	2,722	LF	$ 2.59	$ 7,046.00	$ 6.04	$ 16,442.00	$ 23,488.00
	Temporary Tree Protection (Single High Quality)	Included as Shown			$ -		$ -	$ -
	Temporary Tree Protection (SINGLE)	52	EA	$ 240.52	$ 12,507.00	$ 561.23	$ 29,184.00	$ 41,691.00
	Remove Stump	98	EA	$ 22.02	$ 2,158.00	$ 51.38	$ 5,035.00	$ 7,193.00
	Proposed Minor Tree (8" HT)	Included as Shown			$ -		$ -	$ -
	Proposed Major (4.5" CAL)	Included as Shown			$ -		$ -	$ -
	Shrubs	Included as Shown			$ -		$ -	$ -
	Temporary Tree Protection (GROUP)	Included as Shown			$ -		$ -	$ -
	Temporary Tree Protection (Single High Quality)	Included as Shown			$ -		$ -	$ -
	Remove Stump	Included as Shown			$ -		$ -	$ -
	Cleaning & grubbing, tree removal congested area, below 12" diameter, tree removal, aerial lift truck	98	EA	$ 446.24	$ 43,732.00	$ 1,041.22	$ 102,040.00	$ 145,772.00
	Cleaning & grubbing, tree removal congested area, below 12" diameter, tree removal, aerial lift truck	Included as Shown			$ -		$ -	$ -
	Subtotal				**$ 65,443.00**		**$ 152,701.00**	**$ 218,144.00**

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

ITEM	DESCRIPTION OF WORK	QUANTITY	UNITS	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
33 0000	**UTILITIES**							
33 0500	**Common Work Results for Utilities**							
	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, fittings, 18" lengths, 6" diameter, class 50, excludes excavation backfill	420	LF	$ 61.45	$ 25,807.00	$ 143.38	$ 60,218.00	$ 86,025.00
	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, fittings, 18" lengths, 4" diameter, class 50, excludes excavation backfill	63	LF	$ 61.51	$ 3,875.00	$ 143.54	$ 9,043.00	$ 12,918.00
	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, fittings, 18" lengths, 2" diameter, class 50, excludes excavation backfill	448	LF	$ 25.26	$ 11,318.00	$ 58.95	$ 26,410.00	$ 37,728.00
	Water supply distribution piping, ductile iron pipe, cement lined, mechanical joint, fittings, 18' lengths, 4" diameter, class 50, excludes excavation backfill	Included as Shown			$ -		$ -	$ -
	Tapping, Crosses And Sleeves							
	Water Service Connection, tapping corsses with rubber gaskets, 6" x 4", excludes excavation and backfill	1	ls	$ 17,616.00	$ 17,616.00	$ 41,104.00	$ 41,104.00	$ 58,720.00
	Wells & Accessories							
	Public Water Supply Wells, wells domestic water, pumps, 25 H.P.	0	EA		$ -		$ -	$ -
	Subtotal				**$ 58,616.00**		**$ 136,775.00**	**$ 195,391.00**
33 3100	**Sanitary Utility Sewerage Piping and Structures**							
	Public Sanitary Utility Sewerage Piping, piping polyvinyl chloride pipe, B & S, 13' lengths, 4" diameter, SDR 35, excludes excavation or backfill	253	LF	$ 48.91	$ 12,375.00	$ 114.13	$ 28,876.00	$ 41,251.00
	Septic Tanks							
	Sanitary manhole	2	EA	$ 3,303.00	$ 6,606.00	$ 7,707.00	$ 15,414.00	$ 22,020.00
	Subtotal				**$ 18,981.00**		**$ 44,290.00**	**$ 63,271.00**
33 4000	**Flap Gate (Included w/ other Division 33 sections)**							
33 4100	**Storm Drainage System**							
	Water Quality Structure							
	Vortechnics Units (15'-0"x9'-0"x9'-0") or approved equal - Refer B/C206 (Excavation Incl'd)	1	EA	$ 28,626.00	$ 28,626.00	$ 66,794.00	$ 66,794.00	$ 95,420.00
	Storm Drainage System							
	36" DIA Drywell	1	EA	$ 1,057.00	$ 1,057.00	$ 2,466.00	$ 2,466.00	$ 3,523.00
	12" DIA Schedule 40 Forcemain including excavation	300	LF	$ 174.84	$ 52,452.00	$ 407.96	$ 122,387.00	$ 174,839.00
	4' DIA. Schedule 40 Forcemain including excavation	2,210	LF	$ 16.55	$ 36,575.00	$ 38.62	$ 85,342.00	$ 121,917.00
	1" Flexible Copper Drawdown Pipe to Connect 36" DIA Drywell	50	LF	$ 20.26	$ 1,013.00	$ 47.26	$ 2,363.00	$ 3,376.00
	Connect 12" DIA forcemain to existing 12" DIA forcemain	1	EA	$ 220.00	$ 220.00	$ 514.00	$ 514.00	$ 734.00
	HDPE Stormwater Piping							
	24" HDPE piping	5	LF	$ 132.20	$ 661.00	$ 308.20	$ 1,541.00	$ 2,202.00
	18" HDPE piping	54	LF	$ 21.78	$ 1,176.00	$ 50.81	$ 2,744.00	$ 3,920.00
	15" HDPE piping	209	LF	$ 20.02	$ 4,184.00	$ 46.71	$ 9,762.00	$ 13,946.00
	12" HDPE piping	457	LF	$ 19.18	$ 8,764.00	$ 44.75	$ 20,449.00	$ 29,213.00
	8" HDPE piping	202	LF	$ 18.25	$ 3,686.00	$ 42.58	$ 8,601.00	$ 12,287.00
	6" HDPE piping	112	LF	$ 17.38	$ 1,947.00	$ 40.55	$ 4,542.00	$ 6,489.00

Department of Design and Construction

CONTRACTOR'S BID BREAKDOWN FORM

CONTRACT 1 - GENRAL CONSTRUCTION WORK

Project: Croton Water Treatment Plant Facilities and Landscape Construction
Location: 3651 Jerome Avenue, Bronx NY 10467
Bidder: C & L Contracting Corp.

DDC ID: CRO-AGS
Sponsor Agency: NYC Dept of Environmental Protection

CSI	DESCRIPTION OF WORKS	QUANTITY	UNIT	MATERIAL UNIT COST	MATERIAL TOTAL	LABOR UNIT COST	LABOR TOTAL	TOTAL COST MATERIAL + LABOR
	3.5" HDPE piping	17	LF	$ 18.12	$ 308.00	$ 42.35	$ 720.00	$ 1,028.00
	6" PVC Underdrain	160	LF	$ 6.75	$ 1,080.00	$ 15.75	$ 2,520.00	$ 3,600.00
	24" HDPE Duraslot Level Spreader incl'd Excavation	270	LF	$ 28.22	$ 7,619.00	$ 65.84	$ 17,777.00	$ 25,396.00
	8" HDPE Duraslot Level Spreader incl'd Excavation	185	LF	$ 24.76	$ 4,580.00	$ 57.77	$ 10,687.00	$ 15,267.00
	Storm TD-2,3,4,5,6 (3'-6"L x 0'-10"W)	5	EA	$ 123.20	$ 616.00	$ 287.80	$ 1,439.00	$ 2,055.00
	Storm 5" dia Area Drain	6	EA	$ 440.33	$ 2,642.00	$ 1,027.67	$ 6,166.00	$ 8,808.00
	Storm Drainage Manholes, Frames & Covers							
	Storm Drainage Catch basin - INCLUDING EXCAVATION	9	EA	$ 7,707.00	$ 69,363.00	$ 17,983.00	$ 161,847.00	$ 231,210.00
	Storm Drainage Manholes, Frames, and Covers - INCLUDING EXCAVATION	4	EA	$ 13,212.00	$ 52,848.00	$ 30,828.00	$ 123,312.00	$ 176,160.00
	Steel ladder for manhole	Included as Shown			$ -		$ -	$ -
	Piping, Gas Service And Distribution, Polyethylene Natural gas piping, polyethylene, joints with coupling natural gas distribution, 60 psi, 3" diameter, 40' joints, sdr 11, excludes excavation backfill	330	LF	$ 11.34	$ 3,743.00	$ 26.47	$ 8,735.00	$ 12,478.00
	Subtotal				**$ 283,160.00**		**$ 660,708.00**	**$ 943,868.00**
33 4500	**Hydraulic Sluice Gate**							
	Steel Weir	8	EA	$ 3,633.25	$ 29,066.00	$ 8,477.75	$ 67,822.00	$ 96,888.00
	Modified weir @ weir wall B	1	EA	$ 3,743.00	$ 3,743.00	$ 8,735.00	$ 8,735.00	$ 12,478.00
	Corten steel and trash rack	8	EA	$ 2,257.00	$ 18,056.00	$ 5,266.50	$ 42,132.00	$ 60,188.00
	Steel Weir	Included Above as Shown			$ -		$ -	$ -
	Cor-ten steel and trash rack	Included Above as Shown			$ -		$ -	$ -
	Subtotal				**$ 50,865.00**		**$ 118,689.00**	**$ 169,554.00**
33 4600	**Sub Drainage (included w/ 334100)**							
33 4610	**Stormwater Underground Detention**							
	Subgrade Polyethylene Stormwater Storage System (420,779 gallons)	56,250	CF	$ 8.24	$ 463,682.00	$ 19.23	$ 1,081,925.00	$ 1,545,607.00
	Subtotal				**$ 463,682.00**		**$ 1,081,925.00**	**$ 1,545,607.00**
33 4713	**Wetland Liners**							
	Wetland Liner at cell	77,530	SF	$ 2.23	$ 172,901.00	$ 5.20	$ 403,436.00	$ 576,337.00
	Wetland liner at new and existing gabion wall, 1' W	Included above as Shown			$ -		$ -	$ -
	Subtotal				**$ 172,901.00**		**$ 403,436.00**	**$ 576,337.00**

TOTAL CONTRACT 1 - GENERAL CONSTRUCTION WORK	**$ 25,866,401.00**	**$ 56,907,104.00**	**$ 82,773,505.00**

ATTACHMENT 1 – BID INFORMATION
PROJECT ID: CRO-AGS

DESCRIPTION AND LOCATION OF WORK:

Croton New Above Ground Structure and Landscaping Rebid
3651 Jerome Avenue
Bronx, NY 10467
City of New York

DOCUMENTS AVAILABLE AT:

Department of Design and Construction, Contract Section
30-30 Thomson Avenue - First Floor, Long Island City, NY 11101

SUBMISSION OF BIDS BEFORE BID OPENING:

TIME TO SUBMIT:

On or Before: FEBRUARY 1, 2018

PLACE TO SUBMIT:

Department of Design and Construction, Contract Section
30-30 Thomson Avenue - First Floor, Long Island City, NY 11101

PRE BID QUESTIONS (PBQs):

Please be advised that PBQs must be submitted to the Agency Contact Person at least five (5) business days (by 5:00 P.M. EST) prior to the bid opening date.
Email PBQ(s) - CSB_projectinquiries@ddc.nyc.gov

BID OPENING:

PLACE OF BID OPENING:	Department of Design and Construction
	Contract Section
	30-30 Thomson Avenue - First Floor
	Long Island City, NY 11101
DATE AND HOUR:	**FEBRUARY 1, 2018 @ 2:00PM**

PRE-BID CONFERENCE:

PLACE	**3701 Jerome Ave. Bronx, NY 10467. Entrance on intersection of East 213th Street and Jerome Ave. All visitors are required to have appropriate PPE which includes Hard Hat, Work Boots and Safety Vest.**
DATE AND HOUR	**January 18, 2018 @ 10:00AM**
MANDATORY OR OPTIONAL	**OPTIONAL**

BID SECURITY:

Bid Security is required in the amount set forth below; provided, however, bid security is not required if the TOTAL BID PRICE set forth on the Bid Form is less than $1,000,000.00.

(1) Bond in an amount not less than 10% of the TOTAL BID PRICE set forth on the Bid Form, OR
(2) Certified Check in an amount not less than 2% of the TOTAL BID PRICE set forth on the Bid Form.

PERFORMANCE AND PAYMENT SECURITY:

Required for Contracts in the amount of $1,000,000.00 or more. Performance and Payment Security shall each be in amount equal to 100% of the Contract Price.

AGENCY CONTACT PERSON:

Lorraine Holley, 30-30 Thomson Avenue - First Floor, Long Island City, Queens, 11101
Telephone (718) 391-1016 Email: CSB_projectinquiries@ddc.nyc.gov

THIS PAGE INTENTIONALLY LEFT BLANK

BID BOOKLET
PART B

THIS PAGE INTENTIONALLY LEFT BLANK

SAFETY QUESTIONNAIRE

The bidder must include, with its bid, all information requested on this Safety Questionnaire. Failure to provide a completed and signed Safety Questionnaire at the time of bid opening may result in disqualification of the bid as non-responsive.

1. Bidder Information:

Company Name: C&L Contracting Corp.

DDC Project Number: CRO-AGS

Company Size: _____ Ten (10) employees or less

X Greater than ten (10) employees

Company has previously worked for DDC X YES _____ NO

2. Type(s) of Construction Work

TYPE OF WORK	LAST 3 YEARS	THIS PROJECT
General Building Construction	X	X
Residential Building Construction		
Nonresidential Building Construction	X	X
Heavy Construction, except building		X
Highway and Street Construction		X
Heavy Construction, except highways	X	
Plumbing, Heating, HVAC	X	X
Painting and Paper Hanging	X	X
Electrical Work	X	X
Masonry, Stonework and Plastering	X	X
Carpentry and Floor Work	X	X
Roofing, Siding, and Sheet Metal	X	X
Concrete Work	X	X
Specialty Trade Contracting	X	X
Asbestos Abatement	X	
Other (specify)		
_____	_____	_____

3. Experience Modification Rate:

The Experience Modification Rate (EMR) is a rating generated by the National Council of Compensation Insurance (NCCI). This rating is used to determine the contractor's premium for worker's compensation insurance. The contractor may obtain its EMR by contacting its insurance broker or the NCCI. If the contractor cannot obtain its EMR, it must submit a written explanation as to why.

The Contractor must indicate its Intrastate and Interstate EMR for the past three years. [Note: For contractors with less than three years of experience, the EMR will be considered to be 1.00].

YEAR	INTRASTATE RATE	INTERSTATE RATE
2016	1.01	N/A
2015	0.87	N/A
2014	0.97	N/A

If the Intrastate and/or Interstate EMR for any of the past three years is greater than 1.00, the contractor must attach, to this questionnaire, a written explanation for the rating and identify what corrective action was taken to correct the situation resulting in that rating.

4. OSHA Information:

____ YES _X_ NO Contractor has received a willful violation issued by OSHA or New York City Department of Buildings (NYCDOB) within the last three years.

____ YES _X_ NO Contractor has had an incident requiring OSHA notification within 8 hours (all work-related fatalities) or an incident requiring OSHA notification within 24 hours (all work-related impatient hospitalizations, all amputations and all losses of an eye).

The Occupational Safety and Health Act (OSHA) of 1970 requires employers with ten or more employees, on a yearly basis to complete and maintain on file the form entitled "Log of Work-related Injuries and Illnesses". This form is commonly referred to as the OSHA 300 Log (OSHA 200 Log for 2001 and earlier).

The OSHA 300 Log must be submitted for the last three years for contractors with more than ten employees.

The Contractor must indicate the total number of hours worked by its employees, as reflected in payroll records for the past three years.

The contractor must submit the Incident Rate for Lost Time Injuries (the Incident Rate) for the past three years. The Incident Rate is calculated in accordance with the formula set forth below. For each given year, the total number of incidents is the total number of non-fatal injuries and illnesses reported on the OSHA 300 Log. The 200,000 hours represents the equivalent of 100 employees working forty hours a week, fifty weeks per year.

$$\text{Incident Rate} = \frac{\text{Total Number of Incidents X 200,000}}{\text{Total Number of Hours Worked by Employees}}$$

YEAR	TOTAL NUMBERS OF HOURS WORKED BY EMPLOYEES	INCIDENT RATE
2016	47,430	4.2
2015	43,539	4.6
2014	69,919	5.7

If the contractor's Incident Rate for any of the past three years is one point higher than the Incident Rate for the type of construction it performs (listed below), the contractor must attach, to this questionnaire, a written explanation for the relatively high rate.

General Building Construction	8.5
Residential Building Construction	7.0
Nonresidential Building Construction	10.2
Heavy Construction, except building	8.7
Highway and Street Construction	9.7
Heavy Construction, except highways	8.3
Plumbing, Heating, HVAC	11.3
Painting and Paper Hanging	6.9
Electrical Work	9.5
Masonry, Stonework and Plastering	10.5
Carpentry and Floor Work	12.2
Roofing, Siding, and Sheet Metal	10.3
Concrete Work	8.6
Specialty Trade Contracting	8.6

5. Safety Performance on Previous DDC Project(s)

___YES _X_NO Contractor previously audited by the DDC Office of Site Safety.

DDC Project Number(s): _____, _____, _____

_X_YES ___NO Accident on previous DDC Project(s).

DDC Project Number(s): P079CPP, _____, _____

___YES _X_NO Fatality or Life-altering Injury on DDC Project(s) within the last three years. [Examples of a life-altering injury include loss of limb, loss of a sense (e.g., sight, hearing), or loss of neurological function].

DDC Project Number(s): _____, _____, _____

Date: 1 March 2018

By: _____
(Signature of Owner, Partner, Corporate Officer)

Title: Sec./Treas.

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Note: You can type input into this form and save it. Because the forms in this recordkeeping package are "fillable/writable" PDF documents, you can type into the input form fields and then save your inputs using the free Adobe PDF Reader.

Year 20 16

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	1	0	0
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
128	
(K)	(L)

Injury and Illness Types

Total number of	(M)		
(1) Injuries	1	(4) Poisonings	0
(2) Skin disorders	0	(5) Hearing loss	0
(3) Respiratory conditions	0	(6) All other illnesses	0

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 54 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name: C&L Contracting Corp

Street: 1981 Marcus Ave - Suite E106

City: Lake Success State: NY Zip: 11042

Industry description (e.g., *Manufacture of motor truck trailers*)

General Contractor

Standard Industrial Classification (SIC), if known (e.g., *3715*)

OR

North American Industrial Classification (NAICS), if known (e.g., 336212)

Employment information *(If you don't have these figures, see the Worksheet on the next page to estimate.)*

Annual average number of employees: 45

Total hours worked by all employees last year: 47430

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

[redacted] Office Manager

Company executive Title

Phone 516-326-4465 Date 3/1/19

Save Input

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Note: You can type input into this form and save it. Because the forms in this recordkeeping package are "fillable/writable" PDF documents, you can type into the input form fields and then save your inputs using the free Adobe PDF Reader. In addition, the forms are programmed to auto-calculate as appropriate.

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20 16

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name: C&L Contracting Corp

City: Lake Success State: NY

Identify the person			Describe the case			Classify the case (SELECT ONLY ONE box for each case based on the most serious outcome for that case)				Enter the number of days the injured or ill worker was:		Select the "injury" column or choose one type of illness:					
(A) Case no.	(B) Employee's name	(C) Job title (e.g., Welder)	(D) Date of injury or onset of illness (e.g., 2/14)	(E) Where the event occurred (e.g., Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g., Second degree burns on right forearm from acetylene torch)	(G) Death	(H) Days away from work	(I) Remained at Work: Job transfer or restriction	(J) Remained at Work: Other recordable cases	(K) Away from work	(L) On job transfer or restriction	(M) (1) Injury	(2) Skin disorder	(3) Respiratory condition	(4) Poisoning	(5) Hearing loss	(6) All other illnesses
Reset	Carlos Mayan	Carpenter	9 / 23	C&L's Yard	Carlos was cleaning off the top	○	●	○	○	128 days	___ days	●	○	○	○	○	○
Reset			/	14-20 128th Street	shelf in C&L's garage. He was on a 7'	○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/	College Point, NY 11356	extension ladder which was leaning	○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/		up against the shelf. The ladder slipped	○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/		and Carlos fell backwards off the	○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/		ladder	○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/			○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/			○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/			○	○	○	○	___ days	___ days	○	○	○	○	○	○
Reset			/			○	○	○	○	___ days	___ days	○	○	○	○	○	○
				Page totals ▶		0	1	0	0	128		1	0	0	0	0	0

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Save Input | Add a Form Page

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20 1 5

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name C&L Contracting Corp

City Lake Success State New York

Identify the person			Describe the case			Classify the case				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
(A) Case no.	(B) Employee's name	(C) Job title (e.g., Welder)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g., Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g., Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other recordable cases (J)	Away from work (K)	On job transfer or restriction (L)	(M) Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
68070341329	Mayo Jose	Carpenter	7/23 month/day	Staircase D at Ocean Breeze Athletic Center	Mr Mayo was on Staircase D cutting the metal support for the handrail using a grinder. While he was using the grinder the grinder slipped out of his hand and cut his middle finger on his left hand.		X			32 days	0 days	X					
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
			/ month/day							days	days						
Page totals							1			32	0	1					

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Page ___ of ___

Injury (1) | Skin disorder (2) | Respiratory condition (3) | Poisoning (4) | Hearing loss (5) | All other illnesses (6)

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 20 1 5

U.S. Department of Labor
Occupational Safety and Health Administration
Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	1	0	0
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
32	0
(K)	(L)

Injury and Illness Types

Total number of . . .	(M)		
(1) Injuries	1	(4) Poisonings	
		(5) Hearing loss	
(2) Skin disorders		(6) All other illnesses	
(3) Respiratory conditions			

Establishment information

Your establishment name C&L Contracting Corp

Street 1981 Marcus Avenue

City Lake Success State NY ZIP 11042

Industry description (*e.g., Manufacture of motor truck trailers*)
General Contractor

Standard Industrial Classification (SIC), if known (*e.g., 3715*)
— — — —

OR

North American Industrial Classification (NAICS), if known (e.g., 336212)
— — — — — —

Employment information (*If you don't have these figures, see the Worksheet on the back of this page to estimate.*)

Annual average number of employees 32

Total hours worked by all employees last year 43,539

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Company executive — Office Manager (Title)

516)376-4460 - (Phone) — 1/31/16 (Date)

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 58 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 301
Injury and Illness Incident Report

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

This *Injury and Illness Incident Report* is one of the first forms you must fill out when a recordable work-related injury or illness has occurred. Together with the *Log of Work-Related Injuries and Illnesses* and the accompanying *Summary*, these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents.

Within 7 calendar days after you receive information that a recordable work-related injury or illness has occurred, you must fill out this form or an equivalent. Some state workers' compensation, insurance, or other reports may be acceptable substitutes. To be considered an equivalent form, any substitute must contain all the information asked for on this form.

According to Public Law 91-596 and 29 CFR 1904, OSHA's recordkeeping rule, you must keep this form on file for 5 years following the year to which it pertains.

If you need additional copies of this form, you may photocopy and use as many as you need.

Completed by Jennifer Davis

Title Office Manager

Phone (516) 326 - 4460 Date 1 / 13 / 16

Information about the employee

1) Full name: Jose Mayo

2) Street 257 Pine Street

City Teaneck State NJ ZIP 07666

3) Date of birth 10 / 16 / 1967

4) Date hired 4 / 24 / 2000

5) ☐ Male
☐ Female

Information about the physician or other health care professional

6) Name of physician or other health care professional

7) If treatment was given away from the worksite, where was it given?

Facility Staten Island University Hospital

Street 475 Seaview Avenue

City Staten Island State NY ZIP 10305

8) Was employee treated in an emergency room?
☒ Yes
☐ No

9) Was employee hospitalized overnight as an in-patient?
☐ Yes
☐ No

Information about the case

10) Case number from the *Log* 68070341-329 *(Transfer the case number from the Log after you record the case.)*

11) Date of injury or illness 07 / 23 / 2015

12) Time employee began work 7am AM / PM

13) Time of event 1:15 PM AM / PM ☐ Check if time cannot be determined

14) **What was the employee *doing just before the incident occurred?* Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific. *Examples:* "climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."**

Mr Mayo was on the top landing of staircase D, cutting the metal supports for the handrail. Mr Mayo was using a grinder hr was wearing all safety equipment including hard hat, safety glasses, vest and gloves. While he was using the grinder it slipped and he cut his middle finger on his left hand.

15) **What happened? Tell us how the injury occurred. *Examples:* "When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."**

The grinder slipped out of Mr Mayo's hand while cutting the metal supports for the handrail.

16) **What was the *injury or illness?* Tell us the part of the body that was affected and how it was affected; be more specific than "hurt," "pain," or sore." *Examples:* "strained back"; "chemical burn, hand"; "carpal tunnel syndrome."**

17) **What object or substance directly harmed the employee? *Examples:* "concrete floor"; "chlorine"; "radial arm saw." *If this question does not apply to the incident, leave it blank.***

18) **If the employee died, when did death occur? Date of death** ___ / ___ / ___

Public reporting burden for this collection of information is estimated to average 22 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Persons are not required to respond to the collection of information unless it displays a current valid OMB control number. If you have any comments about this estimate or any other aspects of this data collection, including suggestions for reducing this burden, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 20 14

U.S. Department of Labor
Occupational Safety and Health Administration
Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	1	0	1
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
28	0
(K)	(L)

Injury and Illness Types

Total number of...	(M)		
(1) Injuries	1	(4) Poisonings	
		(5) Hearing loss	
(2) Skin disorders		(6) All other illnesses	
(3) Respiratory conditions			

Establishment information

Your establishment name: C&L Contracting Corp.

Street: 14-20 128th Street

City: College Point State: NY ZIP: 11356

Industry description (*e.g., Manufacture of motor truck trailers*): General Contractor

Standard Industrial Classification (SIC), if known (*e.g., 3715*): ____ ____ ____ ____

OR

North American Industrial Classification (NAICS), if known (e.g., 336212): ____ ____ ____ ____ ____ ____

Employment information (*If you don't have these figures, see the Worksheet on the back of this page to estimate.*)

Annual average number of employees: 32

Total hours worked by all employees last year: 69,919.00

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Company executive: [signature] Title: Admin Assistant

Phone: 718, 886-1958 Date: 2/6/15

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 54 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210 Do not send the completed forms to this office.

OSHA's Form 300 (Rev 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes

Year 20 14

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name: C&L Contracting Corp.
City: College Point State: NY

Identify the person			Describe the case			Classify the case — CHECK ONLY ONE box for each case based on the most serious outcome for that case				Enter the number of days the injured or ill worker was		Check the "Injury" column or choose one type of illness
(A) Case no.	(B) Employee's name	(C) Job title (e.g., Welder)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g., Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g., Second degree burns on right forearm from acetylene torch)			Remained at Work				(M)
						Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other recordable cases (J)	Away from work (K)	On job transfer or restriction (L)	Injury (1)
67243915-329	Paul Ron	Carpenter	2/4/	Allegedly on the scissor lift at ground level	"allegedly Mr Paul was on a scissor lift at ground level. Mr Paul stated that he extended his body from withing the scissor lift guard rail and his right leg got caught in the guard rail." Mr Paul resumed work right after reporting.	☐	☐	☐	☒	0 days	0 days	☐
						☐	☐	☐	☐	___ days	___ days	☐
						☐	☐	☐	☐	___ days	___ days	☐
						☐	☐	☐	☐	___ days	___ days	☐
						☐	☐	☐	☐	___ days	___ days	☐
67248771-329	Paul, Lancelot	Carpenter	5/11/	Track level Terrace south end.	Used a grinder to cut metal framing stud, the grinder wheel blade broke and fragments of the grinding wheel projected and cut his index finger on his left hand.	☐	☒	☐	☐	28 days	___ days	☒
			/__/			☐	☐	☐	☐	___ days	___ days	☐
			/__/			☐	☐	☐	☐	___ days	___ days	☐
			/__/			☐	☐	☐	☐	___ days	___ days	☐
			/__/			☐	☐	☐	☐	___ days	___ days	☐
			/__/			☐	☐	☐	☐	___ days	___ days	☐
			/__/			☐	☐	☐	☐	___ days	___ days	☐
					Page totals>	___	1	___	1	28	0	1

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Page 1 of 1

(1) Injury	(2) Skin disorder	(3) Respiratory condition	(4) Poisoning	(5) Hearing loss	(6) All other illnesses
1					

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N 3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 301
Injury and Illness Incident Report

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

This Injury and Illness Incident Report is one of the first forms you must fill out when a recordable work-related injury or illness has occurred. Together with the *Log of Work-Related Injuries and Illnesses* and the accompanying *Summary*, these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents.

Within 7 calendar days after you receive information that a recordable work-related injury or illness has occurred, you must fill out this form or an equivalent. Some state workers' compensation, insurance, or other reports may be acceptable substitutes. To be considered an equivalent form, any substitute must contain all the information asked for on this form.

According to Public Law 91-596 and 29 CFR 1904, OSHA's recordkeeping rule, you must keep this form on file for 5 years following the year to which it pertains.

If you need additional copies of this form, you may photocopy and use as many as you need.

Completed by: Jennifer Dawn

Title: AA

Phone: (718) 888 6319 Date: 2/6/15

Information about the employee

1) Full name: Paul, Lancelot

2) Street: 179 Quincy Street

City: Brooklyn State: NY ZIP: 11216

3) Date of birth: 12 / 25 / 72

4) Date hired: 11 / 25 / 13

5) [X] Male
[ ] Female

Information about the physician or other health care professional

6) Name of physician or other health care professional

7) If treatment was given away from the worksite, where was it given?

Facility: Staten Island University Hospital

Street: 475 Seaview Avenue

City: Staten Island State: NY ZIP: 10305

8) Was employee treated in an emergency room?
[X] Yes
[ ] No

9) Was employee hospitalized overnight as an in-patient?
[X] Yes
[ ] No

Information about the case

10) Case number from the Log: 57249771 – 329 *(Transfer the case number from the Log after you record the case.)*

11) Date of injury or illness: 02 / 04 / 2014

12) Time employee began work: 7 AM [ ] AM [ ] PM

13) Time of event: 11:45 AM [ ] AM [ ] PM [ ] Check if time cannot be determined

14) **What was the employee doing just before the incident occurred?** Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific. *Examples:* "climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."

Mr Paul was instructed by his supervisor Frankie Rodriguez to use the Saw-All to cut metal framing stud. Instead Mr Paul went and picked up a grinder that did not have a guard on it. It is not known if Mr Paul removed the guard prior to usage or if the grinder was missing the guard. It was observed that next to the grinder Mr Paul selected was a grinder that had a guard on it. According to Charlie Garcia from FMB Steel. Mr Paul asked him if he could borrow a 7 inch grinding wheel, the Grinder that was used only accommodates a 5 inch wheel blade.

15) **What happened?** Tell us how the injury occurred. *Examples:* "When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."

When Mr Paul was using the grinder to cut the metal framing stud the grinding wheel broke and fragments of the grinding wheel projected and cut his index finger on his left hand.

16) **What was the injury or illness?** Tell us the part of the body that was affected and how it was affected; be more specific than "hurt," "pain," or sore." *Examples:* "strained back"; "chemical burn, hand"; "carpal tunnel syndrome."

Mr. Paul was taken to the hospital via ambulance and received medical treatment.

17) **What object or substance directly harmed the employee?** *Examples:* "concrete floor"; "chlorine"; "radial arm saw." *If this question does not apply to the incident, leave it blank.*

18) If the employee died, when did death occur? Date of death

Public reporting burden for the collection of information is estimated to average 22 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, including suggestions for reducing this burden, contact: US Department of Labor, OSHA Office of Statistical Analysis, Washington, DC 20210. Do not send the completed forms to this office.

Pre-Award Process

The bidder is advised that as part of the pre-award review of its bid, it may be required to submit the information described in Sections (A) through (D) below. If required, the bidder must submit such information within five (5) business days following receipt of notification from DDC that it is among the low bidders. Such notification from DDC will be by facsimile or in writing and will specify the types of information which must be submitted.

In the event the bidder fails to submit the required information within the specified time frame, its bid may be rejected as nonresponsive.

****

(A) **Project Reference Form**: If required, the bidder must complete and submit the Project Reference Form set forth on pages 28 through 30 of this Bid Booklet. The Project Reference Form consists of 3 parts: (1) Contracts Completed by the Bidder, (2) Contracts Currently Under Construction by the Bidder, and (3) Pending Contracts Not Yet Started by the Bidder.

(B) **Copy of License**: If required, the bidder must submit a copy of the license under which the bidder will be performing the work. Such license must clearly show the following: (1) Name of the Licensee, (2) License Number, and (3) Expiration date of the License. A copy of the license will be required from bidders for the following contracts: Plumbing Work, Electrical Work and Asbestos Abatement.

(C) **Financial Information**: If required, the bidder must submit the financial information described below:

(1) Audited Financial Statements: Financial statements (Balance Sheet and Income Statement) of the entity submitting the bid, as audited by an independent auditor licensed to practice as a certified public accountant (CPA). Audited financial statements for the three most recent fiscal years must be submitted. Each such financial statement must include the auditor's standard report.

If the bidder does not have audited financial statements, it must submit an affidavit attesting to the fact that the bidder does not have such statements. In addition, the bidder must submit the following documentation covering the three most recent fiscal years: signed federal tax returns, unaudited financial statements, and a "certified review letter" from a certified public accountant (CPA) verifying the unaudited financial statements.

Unless the most recent audited or unaudited financial statement was issued within ninety (90) days, the bidder must submit interim financial information that includes data on financial position and results of operation (income data) for the current fiscal year. Such information may be summarized on a monthly or quarterly basis or at other intervals.

(2) Schedule of Aged Accounts Receivable, including portion due within ninety (90) days.

(D) **Project Specific Information**: If required, the bidder must submit the project specific information described below:

(1) Statement indicating the number of years of experience the bidder has had and in what type of construction.
(2) Resumes of all key personnel to be involved in the project, including the proposed project superintendent.
(3) List of significant pieces of equipment expected to be used for the contract, and whether such equipment is owned or leased.

(4) Description of work expected to be subcontracted, and to what firms, if known.
(5) List of key material suppliers.
(6) Preliminary bar chart time schedule
(7) Contractor's expected means of financing the project. This should be based on the assumption that the contractor is required to finance 2X average monthly billings throughout the contract period.
(8) Any other issues the contractor sees as impacting his ability to complete the project according to the contract.

In addition to the information described in Sections (A) through (D) above, the bidder shall submit such additional information as the Commissioner may require, including without limitation, an explanation or justification for specific unit price items.

The bidder is further advised that it may be required to attend a pre-award meeting with DDC representatives. If such a meeting is convened, the bidder will be advised as to any additional material to be provided.

A. PROJECT REFERENCES – CONTRACTS COMPLETED BY THE BIDDER

List all contracts substantially completed within the last 4 years, up to a maximum of 10, in descending order of date of substantial completion.

Project & Location	Contract Type	Contract Amount ($000)	Date Completed	Owner Reference & Tel. No.	Architect/Engineer Reference & Tel. No. if different from owner

B. PROJECT REFERENCES – CONTRACTS CURRENTLY UNDER CONSTRUCTION BY THE BIDDER

List all contracts currently under construction even if they are not similar to the contract being awarded.

Project & Location	Contract Type	Contract Amount ($000)	Subcontracted to Others ($000)	Uncompleted Portion ($000)	Date Scheduled to Complete	Owner Reference & Tel. No.	Architect/Engineer Reference & Tel. No. if different from owner

C. PROJECT REFERENCES – PENDING CONTRACTS NOT YET STARTED BY THE BIDDER

List all contracts awarded to or won by the bidder but not yet started.

Project & Location	Contract Type	Contract Amount ($000)	Date Scheduled to Start	Owner Reference & Tel. No.	Architect/Engineer Reference & Tel. No. if different from owner

THIS PAGE INTENTIONALLY LEFT BLANK

OFFICE OF THE MAYOR
BUREAU OF LABOR SERVICES
CONTRACT CERTIFICATE

To be completed if the contract is less than $1,000,000

Contractor: _____

Address: _____

_____

Telephone Number: _____

Name and Title of Signatory: _____

_____

Contracting Agency or Owner: _____

Project Number: _____

Proposed Contract Amount: _____

Description and Address of Proposed Contract: _____

Names of Subcontractors in the amount of 750,000 or more on this contract (if not known at this time, so state indicating that trades will be subcontracted):

_____

_____

_____

I, (fill in name of person signing) _____, hereby affirm that I am authorized by the above-named contractor to certify that said contractor's proposed contract with the above-named owner or city agency is less than $1,000,000. This affirmation is made in accordance with Executive Order No. 50 (1980) as amended and its implementing regulations.

_____ _____

Date Signature

WILLFUL OR FRAUDULENT FALSIFICATION OF ANY DATA OR INFORMATION SUBMITTED HEREWITH MAY RESULT IN THE TERMINATION OF ANY CONTRACT BETWEEN THE CITY AND THE BIDDER OR CONTRACTOR AND BAR THE BIDDER OR CONTRACTOR FROM PARTICIPATION IN ANY CITY CONTRACT FOR A PERIOD OF UP TO THREE YEARS. FURTHER, SUCH FALSIFICATION MAY RESULT IN CRIMINAL PROSECUTION.

THIS PAGE INTENTIONALLY LEFT BLANK

IRAN DIVESTMENT ACT COMPLIANCE RIDER

FOR NEW YORK CITY CONTRACTORS

The Iran Divestment Act of 2012, effective as of April 12, 2012, is codified at State Finance Law ("SFL") §165-a and General Municipal Law ("GML") §103-g. The Iran Divestment Act, with certain exceptions, prohibits municipalities, including the City, from entering into contracts with persons engaged in investment activities in the energy sector of Iran. Pursuant to the terms set forth in SFL §165-a and GML §103-g, a person engages in investment activities in the energy sector of Iran if:

(a) The person provides goods or services of twenty million dollars or more in the energy sector of Iran, including a person that provides oil or liquefied natural gas tankers, or products used to construct or maintain pipelines used to transport oil or liquefied natural gas, for the energy sector of Iran; or

(b) The person is a financial institution that extends twenty million dollars or more in credit to another person, for forty-five days or more, if that person will use the credit to provide goods or services in the energy sector in Iran and is identified on a list created pursuant to paragraph (b) of subdivision three of Section 165-a of the State Finance Law and maintained by the Commissioner of the Office of General Services.

A bid or proposal shall not be considered for award nor shall any award be made where the bidder or proposer fails to submit a signed and verified bidder's certification.

Each bidder or proposer must certify that it is not on the list of entities engaged in investment activities in Iran created pursuant to paragraph (b) of subdivision 3 of Section 165-a of the State Finance Law. In any case where the bidder or proposer cannot certify that they are not on such list, the bidder or proposer shall so state and shall furnish with the bid or proposal a signed statement which sets forth in detail the reasons why such statement cannot be made. The City of New York may award a bid to a bidder who cannot make the certification on a case by case basis if:

(1) The investment activities in Iran were made before the effective date of this section (i.e., April 12, 2012), the investment activities in Iran have not been expanded or renewed after the effective date of this section and the person has adopted, publicized and is implementing a formal plan to cease the investment activities in Iran and to refrain from engaging in any new investments in Iran: or

(2) The City makes a determination that the goods or services are necessary for the City to perform its functions and that, absent such an exemption, the City would be unable to obtain the goods or services for which the contract is offered. Such determination shall be made in writing and shall be a public document.

BIDDER'S CERTIFICATION OF COMPLIANCE WITH IRAN DIVESTMENT ACT

Pursuant to General Municipal Law §103-g, which generally prohibits the City from entering into contracts with persons engaged in investment activities in the energy sector of Iran, the bidder/proposer submits the following certification:

[*Please Check One*]

BIDDER'S CERTIFICATION

☒ By submission of this bid or proposal, each bidder/proposer and each person signing on behalf of any bidder/proposer certifies, and in the case of a joint bid each party thereto certifies as to its own organization, under penalty of perjury, that to the best of its knowledge and belief, that each bidder/proposer is not on the list created pursuant to paragraph (b) of subdivision 3 of Section 165-a of the State Finance Law.

☐ I am unable to certify that my name and the name of the bidder/proposer does not appear on the list created pursuant to paragraph (b) of subdivision 3 of Section 165-a of the State Finance Law. I have attached a signed statement setting forth in detail why I cannot so certify.

Dated: Nassau, New York
March, 2018

SIGNATURE

Tony Massaro
PRINTED NAME

Secretary / Treasurer
TITLE

Sworn to before me this
1st day of March 2018

Notary Public

Dated: 3/1/18

JENNIFER M DAVIS
Notary Public, State of New York
No. 01DA6326421
Qualified in Nassau County
Commission Expires June 15, 2019

CITY OF NEW YORK

DIVISION OF LABOR SERVICES

CONSTRUCTION EMPLOYMENT REPORT

FORM C: CURRENT WORKFORCE

Trade:

Excavator - Laborer

Union Affiliation, if applicable

Union #731

Total (Col. #1-10):

2

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):

0

Total Female (Col. #6 – 10):

0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	2									
H										
A										
TRN										
TOT	2									

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM C: CURRENT WORKFORCE

Trade:
Painter/Tapers

Union Affiliation, if applicable
Local #1974

Total (Col. #1-10):
2

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):
1

Total Female (Col. #6 – 10):
0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	1		1							
H										
A										
TRN										
TOT	1		1							

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM C: CURRENT WORKFORCE

Trade:

Mason

Union Affiliation, if applicable

Bricklayers Local #1

Total (Col. #1-10):

1

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):

0

Total Female (Col. #6 – 10):

0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	1									
H										
A										
TRN										
TOT	1									

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM C: CURRENT WORKFORCE

Trade:
Operating Engineer

Union Affiliation, if applicable
Local 14 & 15

Total (Col. #1-10):
1

Total Minority, Male & Female
(Col. #2,3,4,5,7,8,9, & 10):
0

Total Female
(Col. #6 – 10):
0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	1									
H										
A										
TRN										
TOT	1									

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM C: CURRENT WORKFORCE

Trade:
Mason Tenders

Union Affiliation, if applicable
Local #79

Total (Col. #1-10):
3

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):
1

Total Female (Col. #6 – 10):
0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	2	1								
H										
A										
TRN										
TOT	2	1								

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM C: CURRENT WORKFORCE

Trade:
Carpentry

Union Affiliation, if applicable
Local #608

Total (Col. #1-10):
5

Total Minority, Male & Female
(Col. #2,3,4,5,7,8,9, & 10):
0

Total Female
(Col. #6 – 10):
0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	5									
H										
A										
TRN										
TOT	5									

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM C: CURRENT WORKFORCE

TRADE CLASSIFICATION CODES

(J) Journeylevel Workers
(A) Apprentice
(H) Helper
(TRN) Trainee
(TOT) Total by Column

For each trade currently engaged by your company for all work performed in New York City, enter the current workforce for Males and Females by trade classification on the charts below.

Trade: Management

Union Affiliation, if applicable: None

Total (Col. #1-10): 7

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10): 4

Total Female (Col. #6 – 10): 4

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	3					4				
H										
A										
TRN										
TOT	3					4				

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Employment Agency

FORM B: PROJECTED WORKFORCE

Trade:
Lather

Union Affiliation, if applicable
Local #49

Total (Col. #1-10):
3

Total Minority, Male & Female
(Col. #2,3,4,5,7,8,9, & 10):
2

Total Female
(Col. #6 – 10):
0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	1	1	1							
H										
A										
TRN										
TOT	1	1	1							

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM B: PROJECTED WORKFORCE

Trade:
Mason

Union Affiliation, if applicable
Bricklayers Local #1

Total (Col. #1-10):
5

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):
3

Total Female (Col. #6 – 10):
0

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	2	1	2							
H										
A										
TRN										
TOT	2	1	2							

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM B: PROJECTED WORKFORCE

Trade:
Cement Mason

Union Affiliation, if applicable
Local #780

Total (Col. #1-10):
5

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):
3

Total Female (Col. #6 – 10):
0

MALES

	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.
J	2	2	1		
H					
A					
TRN					
TOT	2	2	1		

FEMALES

(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM B: PROJECTED WORKFORCE

Trade:
Laborer

Union Affiliation, if applicable
Mason Tenders #79

Total (Col. #1-10):
8

Total Minority, Male & Female
(Col. #2,3,4,5,7,8,9, & 10):
5

Total Female
(Col. #6 – 10):
1

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	3	2	2				1			
H										
A										
TRN										
TOT	3	2	2				1			

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM B: PROJECTED WORKFORCE

Trade:
Carpenter

Union Affiliation, if applicable
Local 608

Total (Col. #1-10):
3

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):
3

Total Female (Col. #6 – 10):
1

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	1		1			1				
H										
A										
TRN										
TOT	1		1			1				

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Union Hall

FORM B: PROJECTED WORKFORCE

TRADE CLASSIFICATION CODES

(J) Journeylevel Workers
(A) Apprentice
(H) Helper
(TRN) Trainee
(TOT) Total by Column

For each trade to be engaged by your company for this project, enter the projected workforce for Males and Females by trade classification on the charts below.

Trade:
Management

Union Affiliation, if applicable
None

Total (Col. #1-10):
5

Total Minority, Male & Female (Col. #2,3,4,5,7,8,9, & 10):
2

Total Female (Col. #6 – 10):
2

	MALES					FEMALES				
	(1) White Non Hisp.	(2) Black Non Hisp.	(3) Hisp.	(4) Asian	(5) Native Amer.	(6) White Non Hisp.	(7) Black Non Hisp.	(8) Hisp.	(9) Asian	(10) Native Amer.
J	3					2				
H										
A										
TRN										
TOT	3					2				

What are the recruitment sources for you projected hires (i.e., unions, government employment office, job tap center, community outreach)?

Employment Agengy

FORM A. CONTRACT BID INFORMATION: USE OF SUBCONTRACTORS/TRADES

1. Do you plan to subcontractor work on this contract? Yes___ No___

2. If yes, complete the chart below.

NOTE: All proposed subcontractors with a subcontract in excess of $750,000 must complete an Employment Report for review and approval before the contract may be awarded and work commences.

SUBCONTRACTOR'S NAME*	OWNERSHIP (ENTER APPROPRIATE CODE LETTERS BELOW)	WORK TO BE PERFORMED BY SUBCONTRACTOR	TRADE PROJECTED FOR USE BY SUBCONTRACTOR	PROJECTED DOLLAR VALUE OF SUBCONTRACT
		Landscaping		
		Irrigation		
		Fencing		

***If subcontractor is presently unknown, please enter the trade (craft name).**

OWNERSHIP CODES
- W: White
- B: Black
- H: Hispanic
- A: Asian
- N: Native American
- F: Female

FORM A. CONTRACT BID INFORMATION: USE OF SUBCONTRACTORS/TRADES

1. Do you plan to subcontractor work on this contract? Yes___ No___

2. If yes, complete the chart below.

NOTE: All proposed subcontractors with a subcontract in excess of $750,000 must complete an Employment Report for review and approval before the contract may be awarded and work commences.

SUBCONTRACTOR'S NAME*	OWNERSHIP (ENTER APPROPRIATE CODE LETTERS BELOW)	WORK TO BE PERFORMED BY SUBCONTRACTOR	TRADE PROJECTED FOR USE BY SUBCONTRACTOR	PROJECTED DOLLAR VALUE OF SUBCONTRACT
		HVAC		7,204,721
		Electrical		3,009,000
		Sitework/Earthwork	MBE	9,264,673
		Paving	MBE	627,506

***If subcontractor is presently unknown, please enter the trade (craft name).**

OWNERSHIP CODES
- W: White
- B: Black
- H: Hispanic
- A: Asian
- N: Native American
- F: Female

FORM A. CONTRACT BID INFORMATION: USE OF SUBCONTRACTORS/TRADES

1. Do you plan to subcontractor work on this contract? Yes___ No___

2. If yes, complete the chart below.

NOTE: All proposed subcontractors with a subcontract in excess of $750,000 must complete an Employment Report for review and approval before the contract may be awarded and work commences.

SUBCONTRACTOR'S NAME*	OWNERSHIP (ENTER APPROPRIATE CODE LETTERS BELOW)	WORK TO BE PERFORMED BY SUBCONTRACTOR	TRADE PROJECTED FOR USE BY SUBCONTRACTOR	PROJECTED DOLLAR VALUE OF SUBCONTRACT
		Parking Gates		21,235
		Window Treatment		23,970
		Tensioned Shades		1,788,362
		Sprinklers		225,000
		Plumbing	WBE	2,204,825

***If subcontractor is presently unknown, please enter the trade (craft name).**

OWNERSHIP CODES
- W: White
- B: Black
- H: Hispanic
- A: Asian
- N: Native American
- F: Female

FORM A. CONTRACT BID INFORMATION: USE OF SUBCONTRACTORS/TRADES

1. Do you plan to subcontractor work on this contract? Yes___ No___

2. If yes, complete the chart below.

NOTE: All proposed subcontractors with a subcontract in excess of $750,000 must complete an Employment Report for review and approval before the contract may be awarded and work commences.

SUBCONTRACTOR'S NAME*	OWNERSHIP (ENTER APPROPRIATE CODE LETTERS BELOW)	WORK TO BE PERFORMED BY SUBCONTRACTOR	TRADE PROJECTED FOR USE BY SUBCONTRACTOR	PROJECTED DOLLAR VALUE OF SUBCONTRACT
		Tile		76,750
		Flooring		32,321
		Painting		122,663
		Toilet Partitions		17,505
		Operable Partition		53,980

***If subcontractor is presently unknown, please enter the trade (craft name).**

OWNERSHIP CODES
- W: White
- B: Black
- H: Hispanic
- A: Asian
- N: Native American
- F: Female

FORM A. CONTRACT BID INFORMATION: USE OF SUBCONTRACTORS/TRADES

1. Do you plan to subcontractor work on this contract? Yes___ No___

2. If yes, complete the chart below.

NOTE: All proposed subcontractors with a subcontract in excess of $750,000 must complete an Employment Report for review and approval before the contract may be awarded and work commences.

SUBCONTRACTOR'S NAME*	OWNERSHIP (ENTER APPROPRIATE CODE LETTERS BELOW)	WORK TO BE PERFORMED BY SUBCONTRACTOR	TRADE PROJECTED FOR USE BY SUBCONTRACTOR	PROJECTED DOLLAR VALUE OF SUBCONTRACT
		Waterproofing	WBE	229,987
		Roofing	WBE	1,024,803
		Spray Fireproofing		—
		Aluminum & Glass		3,539,960

***If subcontractor is presently unknown, please enter the trade (craft name).**

OWNERSHIP CODES
- W: White
- B: Black
- H: Hispanic
- A: Asian
- N: Native American
- F: Female

FORM A. CONTRACT BID INFORMATION: USE OF SUBCONTRACTORS/TRADES

1. Do you plan to subcontractor work on this contract? Yes___ No___

2. If yes, complete the chart below.

NOTE: All proposed subcontractors with a subcontract in excess of $750,000 must complete an Employment Report for review and approval before the contract may be awarded and work commences.

SUBCONTRACTOR'S NAME*	OWNERSHIP (ENTER APPROPRIATE CODE LETTERS BELOW)	WORK TO BE PERFORMED BY SUBCONTRACTOR	TRADE PROJECTED FOR USE BY SUBCONTRACTOR	PROJECTED DOLLAR VALUE OF SUBCONTRACT
		Demolition		
		Precast		3,926,836
		Masonry		1,324,499
		Steel		4,891,611
		Millwork		458,407

***If subcontractor is presently unknown, please enter the trade (craft name).**

OWNERSHIP CODES
- W: White
- B: Black
- H: Hispanic
- A: Asian
- N: Native American
- F: Female

SIGNATURE PAGE

I, (print name of authorized official signing) C&L Contracting Corp. hereby certify that the information submitted herewith is true and complete to the best of my knowledge and belief and submitted with the understanding that compliance with New York City's equal employment requirements, as contained in Chapter 56 of the City Charter, Executive Order No. 50 (1980), as amended, and the implementing Rules and Regulations, is a contractual obligation. I also agree on behalf of the company to submit a certified copy of payroll records to the Division of Labor Services on a monthly basis.

C&L Contracting Corp.
Contractor's Name

Tony Massaro — Sec./Treas.
Name of person who prepared this Employment Report — Title

Tony Massaro — Sec./Treas.
Name of official authorized to sign on behalf of the contractor — Title

513.326.4460
Telephone Number

Signature of authorized official — 01 March 2018 Date

If contractors are found to be underutilizing minorities and females in any given trade based on Chapter 56 Section 3H, the Division of Labor Services reserves the right to request the contractor's workforce data and to implement an employment program.

Contractors who fail to comply with the above mentioned requirements or are found to be in noncompliance may be subject to the withholding of final payment.

Willful or fraudulent falsifications of any data or information submitted herewith may result in the termination of the contract between the City and the bidder or contractor and in disapproval of future contracts for a period of up to five years. Further, such falsification may result in civil and/and or criminal prosecution.

To the extent permitted by law and consistent with the proper discharge of DLS' responsibilities under Charter Chapter 56 of the City Charter and Executive Order No. 50 (1980) and the implementing Rules and Regulations, all information provided by a contractor to DLS shall be confidential.

Only original signatures accepted.

Sworn to before me this 1st day of March 20 18

JENNIFER M DAVIS
Notary Public, State of New York
Notary No. 01DA6326421
Qualified in Nassau County
Commission Expires June 15, 2019

Authorized Signature — 3/1/18 Date

FOR OFFICIAL USE ONLY: File No.

27. Has any employee, within the past three years, filed a complaint pursuant to an internal grievance procedure or with any official of your firm with respect to equal employment opportunity? Yes___ No_X_

If yes, attach an internal complaint log. See instructions.

28. Has your firm, within the past three years, been named as a defendant (or respondent) in any administrative or judicial action where the complainant (plaintiff) alleged violation of any anti-discrimination or affirmative action laws? Yes___ No_X_

If yes, attach a log. See instructions.

29. Are there any jobs for which there are physical qualifications? Yes___ No_X_

If yes, list the job(s), submit a job description and state the reason(s) for the qualification(s).

_____

_____

30. Are there any jobs for which there are age, race, color, national origin, sex, creed, disability, marital status, sexual orientation, or citizenship qualifications? Yes___ No_X_

If yes, list the job(s), submit a job description and state the reason(s) for the qualification(s).

_____

_____

21. To comply with the Immigration Reform and Control Act of 1986 when and of whom does your firm require the completion of an I-9 Form?

(a) Prior to job offer	Yes___	No X
(b) After a conditional job offer	Yes___	No___
(c) After a job offer	Yes___	No X
(d) Within the first three days on the job	Yes X	No___
(e) To some applicants	Yes___	No X
(f) To all applicants	Yes___	No X
(g) To some employees	Yes___	No X
(h) To all employees	Yes X	No___

22. Explain where and how completed I-9 Forms, with their supportive documentation, are maintained and made accessible.

Maintained in file

23. Does your firm or any of its collective bargaining agreements require job applicants to take a medical examination? Yes___ No X

If yes, is the medical examination given:

(a) Prior to a job offer	Yes___	No___
(b) After a conditional job offer	Yes___	No___
(c) After a job offer	Yes___	No___
(d) To all applicants	Yes___	No___
(e) Only to some applicants	Yes___	No___

If yes, list for which applicants below and attach copies of all medical examination or questionnaire forms and instructions utilized for these examinations.

24. Do you have a written equal employment opportunity (EEO) policy? Yes___ No X

If yes, list the document(s) and page number(s) where these written policies are located.

25. Does the company have a current affirmative action plan(s) (AAP)
_____Minorities and Women
_____Individuals with handicaps
_____Other. Please specify _____

26. Does your firm or collective bargaining agreement(s) have an internal grievance procedure with respect to EEO complaints? Yes___ No X

If yes, please attach a copy of this policy.

If no, attach a report detailing your firm's unwritten procedure for handling EEO complaints.

(a) Name and address of OFCCP office.

_____

_____

(b) Was a Certificate of Equal Employment Compliance issued within the past 36 months? Yes___ No___

If yes, attach a copy of such certificate.

(c) Were any corrective actions required or agreed to? Yes___ No___

If yes, attach a copy of such requirements or agreements.

(d) Were any deficiencies found? Yes___ No___

If yes, attach a copy of such findings.

19. Is your company or its affiliates a member or members of an employers' trade association which is responsible for negotiating collective bargaining agreements (CBA) which affect construction site hiring? Yes___ No_X_

If yes, attach a list of such associations and all applicable CBA's.

PART II: DOCUMENTS REQUIRED

20. For the following policies or practices, attach the relevant documents (e.g., printed booklets, brochures, manuals, memoranda, etc.). If the policy(ies) are unwritten, attach a full explanation of the practices. See instructions.

___ (a) Health benefit coverage/description(s) for all management, nonunion and union employees (whether company or union administered)

___ (b) Disability, life, other insurance coverage/description

___ (c) Employee Policy/Handbook

___ (d) Personnel Policy/Manual

___ (e) Supervisor's Policy/Manual

___ (f) Pension plan or 401k coverage/description for all management, nonunion and union employees, whether company or union administered

___ (g) Collective bargaining agreement(s).

___ (h) Employment Application(s)

___ (i) Employee evaluation policy/form(s).

___ (j) Does your firm have medical and/or non-medical (i.e. education, military, personal, pregnancy, child care) leave policy?

13. Number of employees in your company: 25

14. Contract information:

(a) NYC DDC
Contracting Agency (City Agency)

(b) $ 84,574,604
Contract Amount

(c) 85017B0084
Procurement Identification Number (PIN)

(d) CRO-AGS
Contract Registration Number (CT#)

(e) July 2018
Projected Commencement Date

(f) 1,095 Calendar Days
Projected Completion Date

(g) Description and location of proposed contract:

Croton Above Grade Structure and Landscaping

3651 Jerome, Ave, Bronx 10467

15. Has your firm been reviewed by the Division of Labor Services (DLS) within the past 36 months and issued a Certificate of Approval? Yes X No___

If yes, attach a copy of certificate.

16. Has DLS within the past month reviewed an Employment Report submission for your company and issued a Conditional Certificate of Approval? Yes___ No X

If yes, attach a copy of certificate.

NOTE: DLS WILL NOT ISSUE A CONTINUED CERTIFICATE OF APPROVAL IN CONNECTION WITH THIS CONTRACT UNLESS THE REQUIRED CORRECTIVE ACTIONS IN PRIOR CONDITIONAL CERTIFICATES OF APPROVAL HAVE BEEN TAKEN.

17. Has an Employment Report already been submitted for a different contract (not covered by this Employment Report) for which you have not yet received compliance certificate?
Yes___ No X If yes,

Date submitted: _____
Agency to which submitted: _____
Name of Agency Person: _____
Contract No: _____
Telephone: _____

18. Has your company in the past 36 months been audited by the United States Department of Labor, Office of Federal Contract Compliance Programs (OFCCP)? Yes___ No X

If yes,

The City of New York Department of Small Business Services
Division of Labor Services Contract Compliance Unit
110 William Street, New York, New York 10038
Phone: (212) 513 - 6323
Fax: (212) 618-8879

CONSTRUCTION EMPLOYMENT REPORT

GENERAL INFORMATION

1. Your contractual relationship in this contract is: Prime contractor X Subcontractor ___

1a. Are M/WBE goals attached to this project? Yes X No ___

2. Please check one of the following if your firm would like information on how to certify with the City of New York as a:

___Minority Owned Business Enterprise
___Women Owned Business Enterprise
___Disadvantaged Business Enterprise
___Locally Based Business Enterprise
___Emerging Business Enterprise

2a. If you are certified as an **MBE**, **WBE**, **LBE**, **EBE** or **DBE**, what city/state agency are you certified with? _____ Are you DBE certified? Yes ____ No ____

3. Please indicate if you would like assistance from SBS in identifying certified M/WBEs for contracting opportunities: Yes X No___

4. Is this project subject to a project labor agreement? Yes X No ____

5. Are you a Union contractor? Yes X No ____ If yes, please list which local(s) you affiliated with _____

6. Are you a Veteran owned company? Yes ____ No X

PART I: CONTRACTOR/SUBCONTRACTOR INFORMATION

7. 11-279353 amassaro@clcont.com
Employer Identification Number or Federal Tax I.D. Email Address

8. C&L Contracting Corp.
Company Name

9. 1981 Marcus Ave, Suite E106, Lake Success, NY 11042
Company Address and Zip Code

10. Maunel Santos 516.326.4460
Chief Operating Officer Telephone Number

11. Tony Massaro 516.326.4460
Designated Equal Opportunity Compliance Officer Telephone Number
(If same as Item #10, write "same")

12. same
Name of Prime Contractor and Contact Person
(If same as Item #8, write "same")

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

January 9, 2018

ADDENDUM No. # 1

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Revisions to the Bid Booklet:**
   See Attachment A.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By: _____

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: February 1, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		1/9/18

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

January 9, 2018

ADDENDUM No. # 1

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Revisions to the Bid Booklet:**
   See Attachment A.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

_____
Name of Bidder

By: _____

DDC PROJECT #: CRO-AGS

PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A – REVISIONS TO THE BID BOOKLET

Delete page 22 and replace with revised page 22R, included with this Addendum.

PLA

ATTACHMENT 1 – BID INFORMATION
PROJECT ID: CRO-AGS

DESCRIPTION AND LOCATION OF WORK:

Croton New Above Ground Structure and Landscaping Rebid
3651 Jerome Avenue
Bronx, NY 10467
City of New York

DOCUMENTS AVAILABLE AT:

Department of Design and Construction, Contract Section
30-30 Thomson Avenue - First Floor, Long Island City, NY 11101

SUBMISSION OF BIDS BEFORE BID OPENING:

TIME TO SUBMIT:

On or Before: FEBRUARY 1, 2018
BIDS MUST BE CLOCKED IN PRIOR TO BID OPENING

PLACE TO SUBMIT:

Department of Design and Construction, Contract Section
30-30 Thomson Avenue - First Floor, Long Island City, NY 11101

PRE BID QUESTIONS (PBQs):

Please be advised that PBQs must be submitted to the Agency Contact Person at least five (5) business days (by 5:00 P.M. EST) prior to the bid opening date.
Email PBQ(s) - CSB_projectinquiries@ddc.nyc.gov

BID OPENING:

PLACE OF BID OPENING:	Department of Design and Construction
	Contract Section
	30-30 Thomson Avenue - First Floor
	Long Island City, NY 11101
DATE AND HOUR:	**FEBRUARY 1, 2018 @ 2:00PM**

LATE BIDS WILL NOT BE ACCEPTED

PRE-BID CONFERENCE:

PLACE	**3701 Jerome Ave. Bronx, NY 10467. Entrance on intersection of East 213th Street and Jerome Ave. All visitors are required to have appropriate PPE which includes Hard Hat, Work Boots and Safety Vest.**
DATE AND HOUR	**January 18, 2018 @ 10:00AM**
MANDATORY OR OPTIONAL	**OPTIONAL**

BID SECURITY:

Bid Security is required in the amount set forth below; provided, however, bid security is not required if the TOTAL BID PRICE set forth on the Bid Form is less than $1,000,000.00.

(1) Bond in an amount not less than 10% of the TOTAL BID PRICE set forth on the Bid Form, OR
(2) Certified Check in an amount not less than 2% of the TOTAL BID PRICE set forth on the Bid Form.

PERFORMANCE AND PAYMENT SECURITY:

Required for Contracts in the amount of $1,000,000.00 or more. Performance and Payment Security shall each be in amount equal to 100% of the Contract Price.

AGENCY CONTACT PERSON:

Lorraine Holley, 30-30 Thomson Avenue - First Floor, Long Island City, Queens, 11101
Telephone (718) 391-1041 Email: CSB_projectinquiries@ddc.nyc.gov

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

January 9, 2018

ADDENDUM No. # 2

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Revisions to Volume 3:**
   See Attachment A.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By: _____

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: February 1, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18	AA	1/9/18

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

January 9, 2018

ADDENDUM No. # 2

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Revisions to Volume 3:**
   See Attachment A.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

_____
Name of Bidder

By: _____

DDC PROJECT #: CRO-AGS

PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A – REVISIONS TO VOLUME 3

Delete Volume 3 of the Bid Documents, and replace with revised Volume 3, included with this Addendum.

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

January 19, 2018

ADDENDUM No. # 3

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **The Bid Opening for the contract described below scheduled for February 1, 2018, at 2:00 pm is rescheduled to February 15, 2018 at 2:00 pm.**

   Contract #1 – General Construction Work

2. **Bidders Questions and Responses to Questions:**
   See Attachment A.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By: _____

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: February 15, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date		1/19/18	AA	1/19/18

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

January 19, 2018

ADDENDUM No. # 3

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **The Bid Opening for the contract described below scheduled for February 1, 2018, at 2:00 pm is rescheduled to February 15, 2018 at 2:00 pm.**

   Contract #1 – General Construction Work

2. **Bidders Questions and Responses to Questions:**
   See Attachment A.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

Name of Bidder

By: _____

Attachment A
Addendum # 3
January 19, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	Please provide a bid extension for this project. Additional time is needed.	The Bid opening for the contract described above scheduled for February 01, 2018, at 2:00 pm has been rescheduled to February 15, 2018 at 2:00 pm.

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 2, 2018

ADDENDUM No. # 4

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Drawings:**
   See Attachment B.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Glenn Bruce for B. P.
Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By:

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: February 15, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date; Bidders Questions and Responses to Questions		1/19/18		
#4 Bidders Questions and Responses to Questions; Revisions to the Drawings		2/2/18		

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 2, 2018

ADDENDUM No. # 4

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Drawings:**
   See Attachment B.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Glenn Bruce for B. P.
Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

_____
Name of Bidder

By: _____

Attachment A
Addendum # 4
February 2, 2018

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	Please provide a specification section for Chain-link fencing.	Refer to sheet CROB_L_428. Fence shall comply with standard NYC DPR 10' high chain link fence details. Refer to Attachment B, Revisions to the Drawings, for DPR standard chain link details.
2	In reference to Drawing CROB_P_500, is this the bracing for non-hub pipe of all sizes or for a particular size?	Per Drawing CROB_P_500, the bracing in question is for no-hub pipe of 6" and larger.
3	Kwik – Wall, one of the manufacturers listed for the glass wall, will not manufacture glass taller than 10' 0". The final installed height, with rails will be approximately 10' 6", NOT the 10' 0" shown on drawings.	Glass wall will be 10' 0". Refer to DWG 01 on sheet CROB_A_302 and DWG 05 on CROB_ A-865 for drop ceiling intent.
4	Will there be a list of bidding contractors made available beyond that currently published, as some may opt out of bidding or new ones may join?	Refer to DDC list of plan holders for updated information on the following website for DDC Bid Documents Online: http://ddcbiddocuments.nyc.gov/inet/biddoc/list.aspx?bid_id=1837
5	In reference to Drawing CROB L-401, Detail 2 indicates the standard view of 3'-2 ½" w x 11'-6" long and the varying 3'-2" to 3'-7" wide by varying length up to 11'-6" long. Can Contractors precast these slabs at the sizes indicated?	No, the landscape paving shall be cast-in-place concrete, per the design drawings, to achieve the layouts and alignments shown as well as for continuity with previously built design packages. See sheet CROB L_401 for all information.
6	Per Addendum #3, the Bid Opening Date has been moved to February 15, 2018. We respectfully request that the extent of work be further considered, and an additional extension be provided.	The Bid Opening Date will remain February 15, 2018 at 2:00 pm.
7	Is there a published budget specific to this phase of the overall project? If yes, please identify this. Will the project proceed if the budget is exceeded?	There is no published budget.
8	The Bid Advertisement notes a duration of 30 months for this project. Please confirm this duration is correct.	The contract duration for this project, as noted in Schedule A of the Addendum to the General Conditions, is 900 Consecutive Calendar Days.
9	To accurately estimate the costs associated with the project schedule and how it is impacted by different times of the year, it is important to have knowledge of the start date. When is the anticipated start date?	Construction is anticipated to commence Summer 2018.

10	Will all electronic project documents and models for each discipline be provided for the project?	No, BIM models and CAD files for each discipline, or other electronic project documents, will not be provided for the project.
11	Please describe how temporary utility services will be switched over from existing operations to operations for this project.	The existing electrical services will be terminated at the point of entry. The Contractor shall be responsible to establish all new accounts and connections.
12	Please provide a specification for the Wood Flooring (WD-11).	Refer to Specification section 064023, Sub-section 2.1F, as well as Drawing sheet CRO_A_150 for location of WD_11 in PRO SHOP 103 + PRO SHOP 102.
13	Is the site open for additional follow up site visits?	No, the site is not accessible for additional visits. Note: much of the site can be viewed from the elevated train platform.

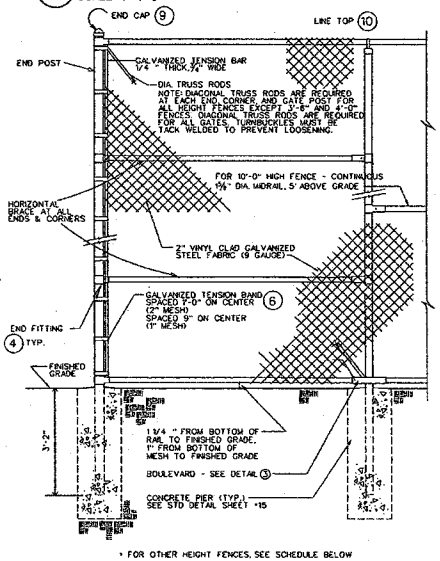
DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT B – DPR STANDARD CHAIN LINK FENCE DRAWINGS

The following DPR Standard Chain Link Fence Drawings are included with this Addendum:

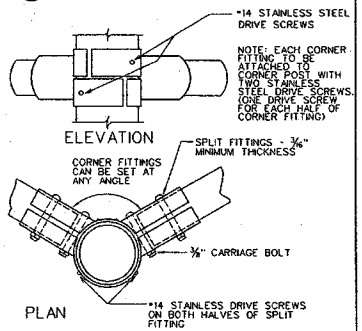
1) Chain Link Fence - Single Gate, Dated 01-15-2006.
2) Chain Link Fence - Details, Dated 01-15-2006.
3) Chain Link Fence - Special Conditions, Dated 01-15-2006.

1 10'-0" HIGH CHAIN LINK FENCE *
SCALE: 1"=1'-0"

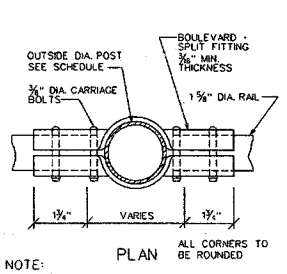


* FOR OTHER HEIGHT FENCES, SEE SCHEDULE BELOW

2 CORNER FITTING
SCALE: HALF SCALE

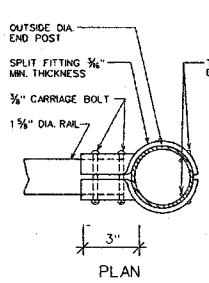


3 BOULEVARD
SCALE: HALF SCALE



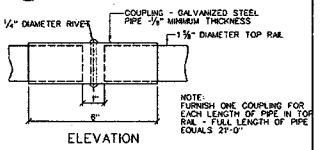
NOTE:
A-1¾" FOR 2" - 4½" O.D. POST
B-1⅝" FOR 2" O.D. OR SMALLER POST
C-2½" NOM. O.D. OR LARGER - 2 BOLTS REQUIRED

4 END FITTING
SCALE: HALF SCALE

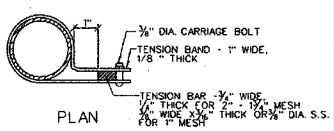


NOTE: MINIMUM WIDTH OF END FITTING TO BE 2¼"

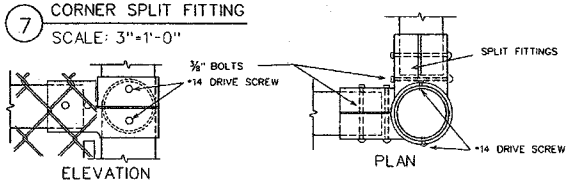
5 TOP RAIL COUPLING
SCALE: HALF SCALE



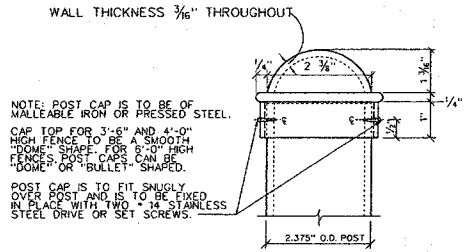
6 TENSION MEMBERS
SCALE: HALF SCALE



7 CORNER SPLIT FITTING
SCALE: 3"=1'-0"



8 SMALL POST CAP
SCALE: FULL SCALE

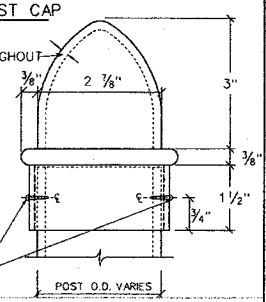


NOTE: POST CAP IS TO BE OF MALLEABLE IRON OR PRESSED STEEL.

CAP TOP FOR 3'-6" AND 4'-0" HIGH FENCE TO BE A SMOOTH "DOME" SHAPE. FOR 6'-0" HIGH FENCES POST CAPS CAN BE "DOME" OR "BULLET" SHAPED.

POST CAP IS TO FIT SNUGLY OVER POST AND IS TO BE FIXED IN PLACE WITH TWO #14 STAINLESS STEEL DRIVE OR SET SCREWS.

9 END, CORNER, & GATE POST CAP
SCALE: FULL SCALE



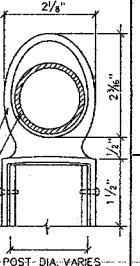
NOTE: POST CAP IS TO BE OF MALLEABLE IRON.

FOR 4" OUTSIDE DIAMETER POST, POST CAP SHALL POSSESS DIMENSIONS THAT ARE IN PROPORTION TO DIMENSIONS BELOW FOR 2⅜" OUTSIDE DIAMETER POST CAP.

CAP TOPS FOR 3" OUTSIDE DIA. AND 4" OUTSIDE DIA POSTS ARE TO POSSESS A SMOOTH "BULLET" SHAPE. FOR 2½" OUTSIDE DIA POST CAP - SEE DETAIL (9)

POST CAP IS TO FIT SNUGLY OVER POST AND IS TO BE FIXED IN PLACE WITH TWO #14 STAINLESS STEEL DRIVE OR SET SCREWS.

10 POST LINE TOP
SCALE: FULL SCALE



NOTE: WIDTH OF LINE TOP OVAL TO BE MINIMUM OF 5/8" AND A MAXIMUM OF 7/8". LINE TOP IS TO BE OF MALLEABLE IRON.

INSIDE OF LINE TOP OVAL IS TO BE ALIGNED WITH OUTSIDE WALL OF LINE POST. CHAIN LINK MESH MUST BE STRAIGHT FROM LINE POST TO TOP RAIL.

WALL THICKNESS TO BE 3/16" THROUGHOUT

1 5/8" DIA. TOP RAIL

POST CAP IS TO FIT SNUGLY OVER POST AND IS TO BE FIXED IN PLACE WITH TWO #14 STAINLESS STEEL DRIVE OR SET SCREWS.

BOLT AND FABRIC NOTES

PEEN END OF ALL BOLTS.

BOLTS WHICH ARE INSTALLED 6' OR LESS ABOVE GRADE SHALL NOT PROTUDE MORE THAN¼" BEYOND THE NUT AFTER TIGHTENING. ALL ROUGH EDGES SHALL BE FILED SMOOTH TO THE SATISFACTION OF THE ENGINEER.

ON FENCES OVER 12 FEET HIGH WHERE THE TWO WIDTHS OF FABRIC ARE REQUIRED, THE BOTTOM PIECE SHALL BE KNUCKLED TOP AND BOTTOM AND THE TOP PIECE KNUCKLED AT BOTTOM AND BARBED AT TOP.

THE TWO PIECES SHALL BE SPLICED IN SUCH A WAY AS TO GIVE A FINISHED NEAT APPEARANCE.

FABRIC TO BE KNUCKLED AT TOP AND BOTTOM RAILS ON FENCES UP TO AND INCLUDING 5'-0" HIGH AND BARBED AT TOP RAIL ON FENCES OVER 6'-0" HIGH.

WIRE FABRIC NOTES

THE MESH SHALL BE PLACED ON THE OUTSIDE OF THE POSTS OF ALL EXTERIOR CHAINLINK FENCES INCLUDING HOODED BACKSTOPS AND HANDBALL COURT FENCES WHERE THESE ARE AN INTEGRAL PART OF THE EXTERIOR FENCE.

WHERE HOODED BACKSTOPS AND HANDBALL COURT FENCES ARE IN INTERIOR AREAS, THE MESH SHALL BE PLACED ON THE INSIDE OF THE POSTS.

SCHEDULE OF SIZES OF MEMBERS - AS PER ASTM A 53, ALL SIZES NPS

HEIGHT OF FENCE	DIAMETER OF LINE POSTS	POST SPACING MAXIMUM	CORNER & END POST	TOP RAIL	MID RAILS	BOTTOM RAIL	DEPTH OF POST INTO CURB AND FTG AT: LINE POST	DEPTH OF POST INTO CURB AND FTG AT: END/CORNER/GATE POST	HORIZONTAL BRACES AT CORNER & END POST	DIAGONAL BRACES
3'-6" & 4'-0"	2"	6'-0"	2½"	1⅝"	0	1⅝"	1'-0"	1'-0"	0	0
6'-0"	2"	6'-0"	2½"	1⅝"	0	1⅝"	1'-8"	1'-8"	0	½" DIA.
8'-0"	2½"	8'-0"	3"	1⅝"	0	1⅝"	1'-8"	1'-8"	1 AT 1⅝"	½" DIA.
10'-0"	3"	10'-0"	4"	1⅝"	1 - 1⅝"	1⅝"	3'-2"	3'-2"	2 AT 1⅝"	½" DIA.
12'-0"	3"	10'-0"	4"	1⅝"	1 - 1⅝"	1⅝"	3'-2"	4'-2"	2 AT 1⅝"	½" DIA.
14'-0"	3½"	10'-0"	4"	1⅝"	2 - 1⅝"	1⅝"	3'-2"	4'-2"	2 AT 1⅝"	½" DIA.
16'-0"	3½"	10'-0"	4"	1⅝"	2 - 1⅝"	1⅝"	3'-2"	4'-2"	2 AT 1⅝"	½" DIA.
18'-0"	3½"	10'-0"	4"	1⅝"	2 - 1⅝"	1⅝"	3'-2"	4'-2"	2 AT 1⅝"	½" DIA.
20'-0"	4½"	10'-0"	4½"	1⅝"	3 - 1⅝"	1⅝"	4'-2"	4'-6"	3 AT 1⅝"	½" DIA.

FABRIC WIDTHS

HEIGHT OF FENCE	WIDTH OF BOTTOM FABRIC	WIDTH OF TOP FABRIC
3'-6" - 4'-0"	3'-6" - 4'-0"	0
6'-0"	5'-0"	0
8'-0"	8'-0"	0
10'-0"	10'-0"	0
12'-0"	8'-0"	4'-0"
14'-0"	10'-0"	4'-0"
16'-0"	10'-0"	6'-0"
18'-0"	10'-0"	8'-0"
20'-0"	10'-0"	10'-0"

PIPE SCHEDULE

NOMINAL OUTSIDE DIAMETER	ACTUAL OUTSIDE DIAMETER
1⅝"	1.660
2"	2.375
2½"	2.875
3"	3.500
3½"	4.000
4"	4.500
4½"	5.000

PIPE & RAIL NOTES

PIPE POSTS AND RAILS SHALL BE TYPE I OR TYPE II:

TYPE I- ROUND MEMBERS SHALL BE HOT DIPPED GALVANIZED CONFORMING TO ASTM A - 53, STANDARD WEIGHT SCHEDULE 40

TYPE II - ROUND MEMBERS SHALL BE MANUFACTURED FROM STEEL CONFORMING TO ASTM A - 569 COLD ROLLED WELDED AND HAVE TENSILE STRENGTH OF 50,000 PSI GIVEN CORROSION PROTECTION AS PER SPEC FOR SS - 40

PROVIDE ADDITIONAL RAIL IN LOWER THIRD OF FENCE AT BASKETBALL BACKSTOPS, AT EACH END OF BASKETBALL COURTS AND AT AROUND HANDBALL COURTS

SEE STANDARD DETAILS #43 AND #42

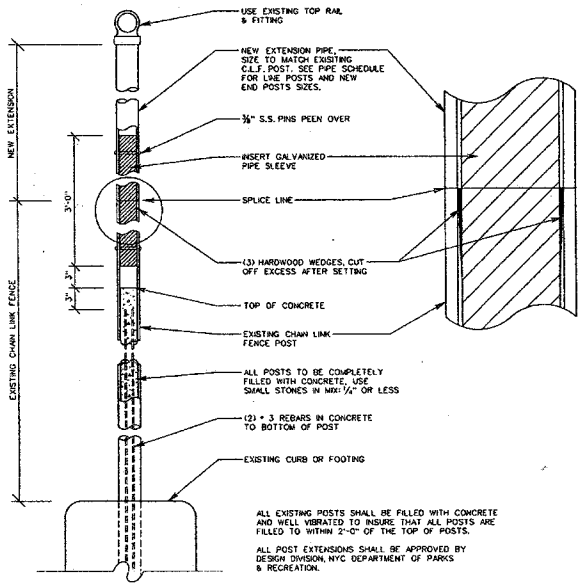
City of New York
Parks & Recreation
Olmsted Center
Flushing Meadows Corona Park
Flushing, New York 11368

PROJECT TITLE	
DRAWING TITLE	CHAIN LINK FENCE - DETAILS
DRAWN BY: STAFF	CHECKED BY: S. ELLIS
APPROVED BY	STANDARD D.P.R. DETAIL: TYLA / 146-R7 (22)
APPROVED BY DIRECTOR: CELIA M. PETERSEN, R.L.A.	CONTRACT NO.
DATE: 1-15-05	SCALE: AS SHOWN

COPYRIGHT © 1990 NYC PA ATION

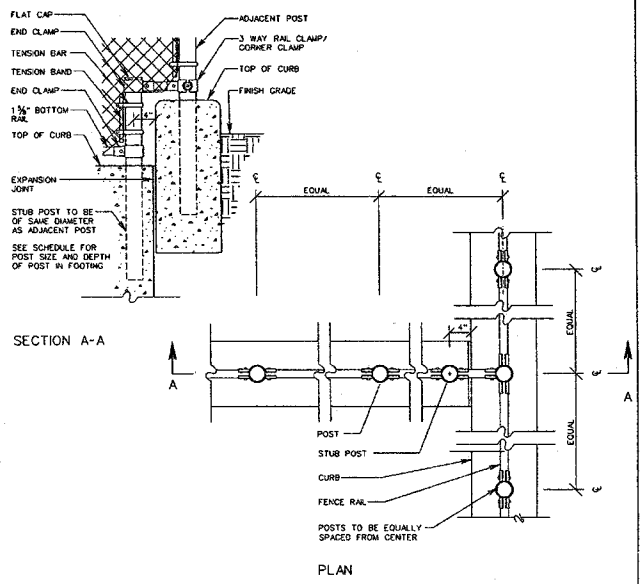
1 EXTEND FENCE HEIGHT - SECTION

SCALE: 3" = 1'-0"



2 DIFFERENT CURB ELEVATIONS

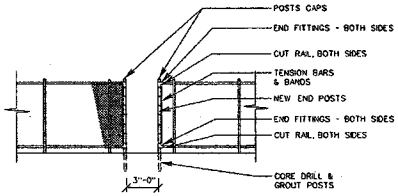
SCALE: 1½" = 1'-0"



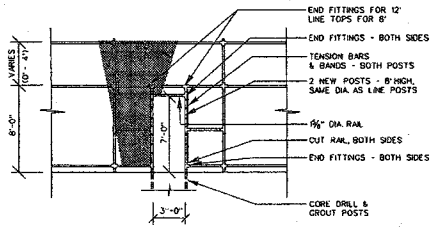
3 SUPPLY NEW PORTAL

SCALE: ¼" = 1'-0"

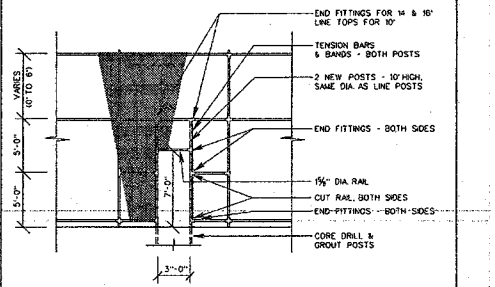
CHAIN LINK FENCE UNDER 8' HIGH



CHAIN LINK FENCE 8' OR 12' HIGH

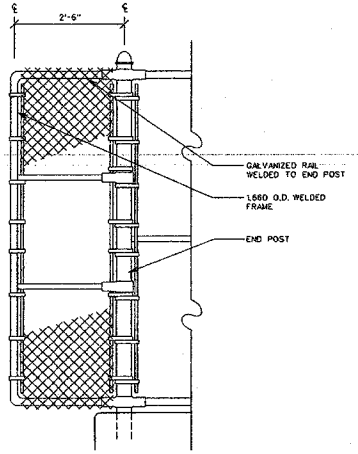


CHAIN LINK FENCE 10', 14' OR 16' HIGH



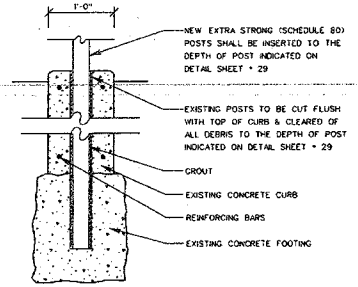
4 PROTECTIVE END PIECE

SCALE: 1" = 1'-0"



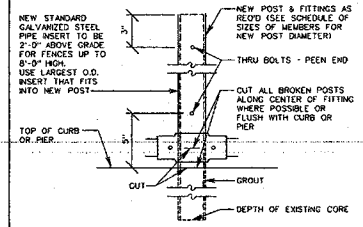
5 REPLACE FENCE POST 10'-0" HT. & OVER

SCALE: 1½" = 1'-0"



6 REPLACE FENCE POST UP TO 8'-0"

SCALE: 3" = 1'-0"



SCHEDULE FOR POST INSERTS

EXISTING POST DIAMETER	NOMINAL O.D. PIPE SIZE	2"	2½"	3"	3½"	4"
	ACTUAL O.D. PIPE SIZE	1.9"	2.375"	2.875"	3½"	4"
	ACTUAL I.D. PIPE SIZE	1.610"	2.067"	2.469"	3.068"	3.548"
SLEEVE DIAMETER REQUIRED	NOMINAL O.D. PIPE SLEEVE	SLEEVE METHOD NOT POSSIBLE FOR 2" O.D. PIPE	2"	2½"	3"	3½"
	ACTUAL O.D. PIPE SLEEVE		1.9"	2.375"	2.875"	3½"

City of New York
Parks & Recreation
Olmsted Center
Flushing Meadows Corona Park
Flushing, New York 11368

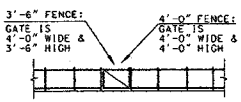
PROJECT TITLE

DRAWING TITLE: CHAIN LINK FENCE - SPECIAL CONDITIONS

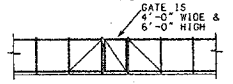
DRAWN BY: STAFF	CHECKED BY: S. ELLIS
APPROVED BY: [illegible]	STANDARD O.P.R. DETAIL TYLA / R146-R7 (30)
APPROVED BY DIRECTOR CELIA M. PETERSEN, R.L.A.	CONTRACT NO.
DATE: 1-15-06	SCALE: AS SHOWN

SHEET [illegible] OF [illegible]

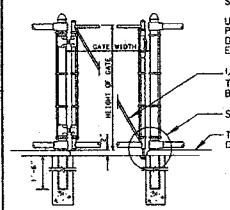
1 4'-0" & 3'-6" FENCE
SCALE: 1/8" = 1'-0"



5 6'-0" FENCE
SCALE: 1/8" = 1'-0"



2 4'-0" SINGLE FENCE GATE
SCALE: 3/4"=1'-0"



4'-0" WIDE

NOTES:

3'-6",4'-0",& 6'-0" FENCE SINGLE GATES SIMILAR.

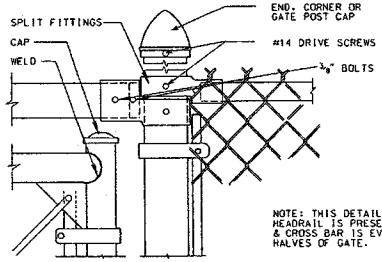
USE LOCKING DEVICE AT PERIMETER FENCES ONLY, OR AS DIRECTED BY ENGINEER.

1/2" DIAM. STEEL TRUSS WITH TURN BUCKLE

SEE DETAIL #10

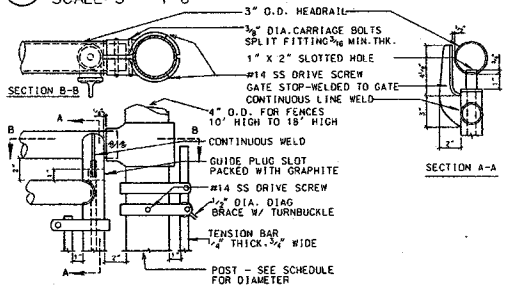
TOP OF CURB OR PIER

3 GATE POST SPLIT FITTING AND CAP
SCALE: 3"=1'-0"

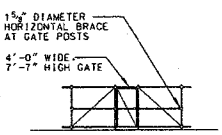


NOTE: THIS DETAIL USED WHEN HEADRAIL IS PRESENT ABOVE GATE & CROSS BAR IS EVEN WITH BOTH HALVES OF GATE.

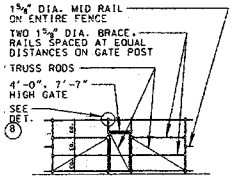
4 GATE STOP TYPE 'B' - TOP
SCALE: 3" = 1'-0"



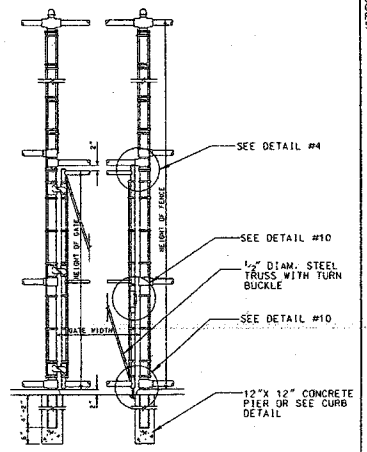
6 8'-0" FENCE
SCALE: 1/8" = 1'-0"



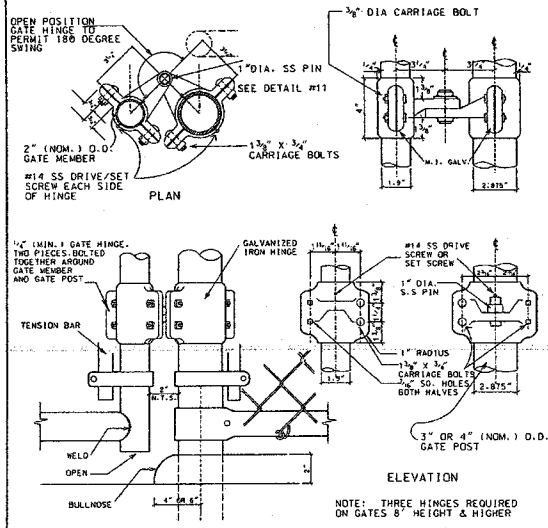
7 10'-0" FENCE
SCALE: 1/8" = 1'-0"



8 12'-0" SINGLE FENCE GATE
SCALE: 3/4"=1'-0"

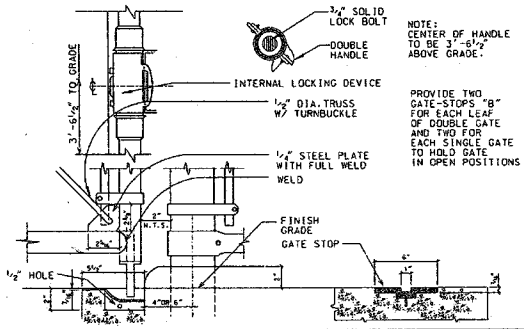


9 MALLEABLE IRON HINGE
SCALE: 4"=1'-0"

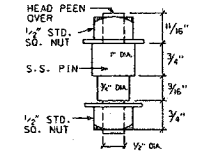


NOTE: THREE HINGES REQUIRED ON GATES 8' HEIGHT & HIGHER

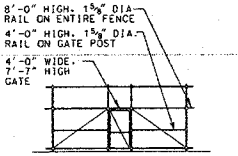
10 GATE LOCK GATE STOP TYPE "B" - BOTTOM
SCALE: 3"=1'-0"



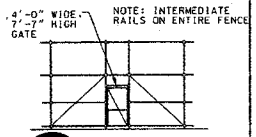
11 GATE PIN
FULL SCALE



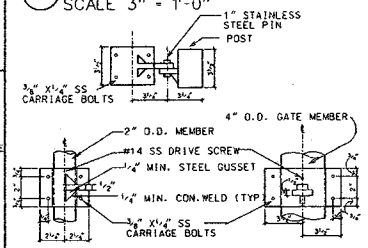
12 12'-0" FENCE
SCALE: 1/8" = 1'-0"



13 16'-0" FENCE
SCALE: 1/8" = 1'-0"



14 PRESSED STEEL HINGE
SCALE 3" = 1'-0"



SCHEDULE OF MEMBER SIZES

PIPE POSTS & RAILS SHALL BE TYPE I OR TYPE II

TYPE I: ROUND MEMBERS SHALL BE HOT DIPPED GALVANIZED CONFORMING WITH ASTM-A-53 STANDARD WEIGHT SCHEDULE 40

TYPE II: ROUND MEMBERS SHALL BE MANUFACTURED FROM STEEL CONFORMING TO ASTM-A569 COLD ROLLED WELDED. HAVE A TENSILE STRENGTH OF 50,000 P.S.I. AND BE GIVEN CORROSION PROTECTION AS PER SPECIFICATIONS FOR SS-40 PIPE.

HEIGHT OF FENCE	DIAMETER OF LINE POSTS	POST SPACING MAXIMUM	GATE POST	HORIZ BRACE AT GATE POST	SIZE OF GATE MEMBERS	HORIZ BRACE ON GATES	SINGLE GATE HEIGHT	SINGLE GATE WIDTH	DIAG. TRUSS ON GATE	DIAG. TRUSS-FENCE PANELS	PORTAL	HEAD RAIL	DEPTH OF POST FOOTING
3'-6"	2"	6'-0"	3"	0	2"	0	3'-6"	4'-0"	1/2" DIAM.	0	NO	0	1'-6"
4'-0"	2"	6'-0"	3"	0	2"	0	4'-0"	4'-0"	1/2" DIAM.	0	NO	0	1'-6"
6'-0"	2"	6'-0"	3"	0	2"	0	6'-0"	4'-0"	1/2" DIAM.	1/2" DIAM.	NO	0	2'-0"
8'-0"	2 1/2"	8'-0"	3"	(1) - 1 5/8"	2"	1 5/8"	7'-7"	4'-0"	1/2" DIAM.	1/2" DIAM.	NO	0	2'-0"
10'-0"	3"	10'-0"	4"	(2) - 1 5/8"	2"	1 5/8"	7'-7"	4'-0"	1/2" DIAM.	1/2" DIAM.	YES	3"	3'-2"
12'-0"	3"	10'-0"	4"	(2) - 1 5/8"	2"	1 5/8"	7'-7"	4'-0"	1/2" DIAM.	1/2" DIAM.	YES	3"	4'-2"
16'-0"	3 1/2"	10'-0"	4"	(2) - 1 5/8"	2"	1 5/8"	7'-7"	4'-0"	1/2" DIAM.	1/2" DIAM.	YES	3"	4'-2"

NOMINAL THICKNESS CHARTS

SS-40

NOMINAL O.D. SIZE	ACTUAL I.D. SIZE	ACTUAL O.D. SIZE	STEEL WT/LF
1 5/8"	1.549	1.660	1.84
2"	1.780	1.900	2.28
2 1/2"	2.245	2.375	3.12
3"	2.715	2.875	4.64
3 1/2"	3.340	3.500	5.71
4"	3.840	4.000	6.56

SCHEDULE 40 - ASTM A53

NOMINAL PIPE SIZE	ACTUAL I.D. SIZE	ACTUAL O.D. SIZE	STEEL WT/LF
1 1/4"	1.380	1.660	2.27
1 1/2"	1.610	1.900	2.72
2"	2.067	2.375	3.65
2 1/2"	2.469	2.875	5.79
3"	3.068	3.500	7.58
3 1/2"	3.548	4.000	9.11

City of New York
Parks & Recreation
Olmsted Center
Flushing Meadows Corona Park
Flushing, New York 11368

PROJECT TITLE

DRAWING TITLE: CHAIN LINK FENCE - SINGLE GATE

DRAWN BY: STAFF — CHECKED BY: S. ELLIS

APPROVED BY: — STANDARD DEPT. DETAIL: TYLA / 146-R7 — 31

APPROVED BY DIRECTOR: CELIA M. PETERSEN, R.L.A. — CONTRACT NO.

DATE: 1-15-06 — SCALE: AS SHOWN — SHEET

COPYRIGHT © 1990 NYC PA ATION

user-server-directory-drawings-sat-ups-nons mmm-dd-rrr

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 6, 2018

ADDENDUM No. # 5

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Addendum to the General Conditions:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By: _____

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: February 15, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date; Bidders Questions and Responses to Questions		1/19/18		
#4 Bidders Questions and Responses to Questions; Revisions to the Drawings		2/2/18		
#5 Bidders Questions and Responses to Questions; Revisions to the Addendum to the General Conditions; Revisions to the Drawings		2/6/18		2/7/18

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 6, 2018

ADDENDUM No. # 5

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Addendum to the General Conditions:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

Name of Bidder

By: _____

Attachment A
Addendum # 5
February 6, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	Please describe the permit requirements associated with this project.	As noted in the 'Information for Bidders,' in Volume 2 of the Contract Documents, the successful bidder will be required to obtain all necessary licenses and permits necessary to perform the work. The permits necessary for this project are included, but not limited to, those shown on Permit List 6.03 on Sheet CROB_A_030. In addition, any Tree removal permits will need to be obtained from DPR. Refer to DDC General Conditions in Volume 2 of the Contract Documents for further clarification on individual permit procedures.
2	In reference to Drawing CROB_A_111, there is no pocket door noted here, only a sliding swing door. Please confirm an open pocket and where the panels will be stored away. Also, the Drawings show a perpendicular layout, while the actual stack will be parallel to the main run.	Pocket door and open Pocket are indicated on Drawing CROB_A_111 in Partition storage room 110A. Provide Single Sliding Pocket Door (parallel) stacking option. See Revised Drawing CROB_A_111 with Attachment C, Revisions to the Drawings, for updated parallel stack configuration and location of wood pocket door opening 110A.
3	Will Health Department Inspections be part of this project?	No, Health Department Inspections will not be required as part of the construction contract for the project.
4	In reference to Specification section 044020, "Exterior Stone Boulders," Article 1.6 D (Stone Selection and Approval), how many visits to each quarry are required for the examination of the blocks?	One visit to each quarry will be required by the Commissioner.
5	In reference to Specification section 044020, "Exterior Stone Boulders," Article 1.6 F (Stone Boulder Mock-Up), please confirm if five mock-ups are required. If so, will the Contractor be able to reuse the boulders from the first mock-up in mock-ups 2-5? Or will five separate sets of stone will be required for each mock-up?	Yes, five mock-ups required, and five sets of boulders are required (one set per mock-up).
6	In reference to Specification section 044020, "Exterior Stone Boulders," Article 2.3 B (Sources for Stone Boulders), there are in excess of 800 boulders needed for the project. Will the contractor be able to procure the material from multiple suppliers?	Yes, it is permissible to procure the stone from multiple suppliers provided the same stone type and quality are maintained. Stones must match for uniformity for workmanship and visual characteristics. Prior to procurement of materials from multiple suppliers, contractor shall obtain Commissioner's approval.
7	Specification section 230010, "Mechanical General Conditions," Article 1.7 refers to Acoustical Compliance requirements. Please clarify if and when an Acoustic Engineer will be required for the HVAC scope of work.	Yes, an Acoustic Engineer will be required. The Contractor shall ensure that all mechanical equipment installed meets the noise criteria of the surrounding area according to the local code and law. Contractor shall engage an Acoustic Engineer to review all equipment submittals to ensure compliance is met and provide a report indicating compliance as well as the noise levels prior to construction beginning and after construction is complete. The Contractor shall submit acoustical compliance report to the Commissioner for approval.

8	Will the City of NY, Commissioner, or Construction Manager require a temporary trailer for their use? If yes, who is responsible for the associated set up and rental costs?	Refer to Attachment B, Revisions to the Addendum to the General Conditions, for this information.
9	The Drawings identify that existing structures, which appear to be the current construction trailers, are to be demolished. Will any temporary construction trailers that are currently onsite be removed prior to the start of this project? If so, when will they be removed and/or demolished? Will Contractors from previous phases have trailers on site as well?	All existing office trailers will be removed from the site with the exception of the one noted in Attachment B, Revisions to the Addendum to the General Conditions. All other existing office trailers will be removed prior to the start of this Contract. There will be no existing contractor trailers on-site from previous phases of the larger project.

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT B – REVISIONS TO THE ADDENDUM TO THE GENERAL CONDITIONS

Include the following text to 'Additional Sections/ Sub-Sections' on page 4:

Section 015000 Temporary Facilities, Services and Controls
Add the following text:
Article 3.8 F: Additional Site Trailers

The existing office trailer indicated to remain on the Drawings, will remain for the duration of the project. See sheet CROA_G_032 Site Logistics Plan by Liro Construction dated August 29, 2017.

The Contractor is to provide power and water and temporary bathroom facilities to the existing office trailer. Specifically, the Contractor shall partition off a portion of the existing trailer to create an indoor conditioned space, code compliant, bathroom, complete with toilet, hand sink, lighting, exhaust fan, door with privacy lockset, which are serviced by a water supply and exterior sanitary holding tank. The Contractor shall be responsible for the installation and monthly costs for utility services not limited to internet, telephone, water, electric and sanitary system as stated above. The Contractor shall also include all costs for relocating the existing office trailer as required during construction and removing the existing office trailer at the end of the project from the site.

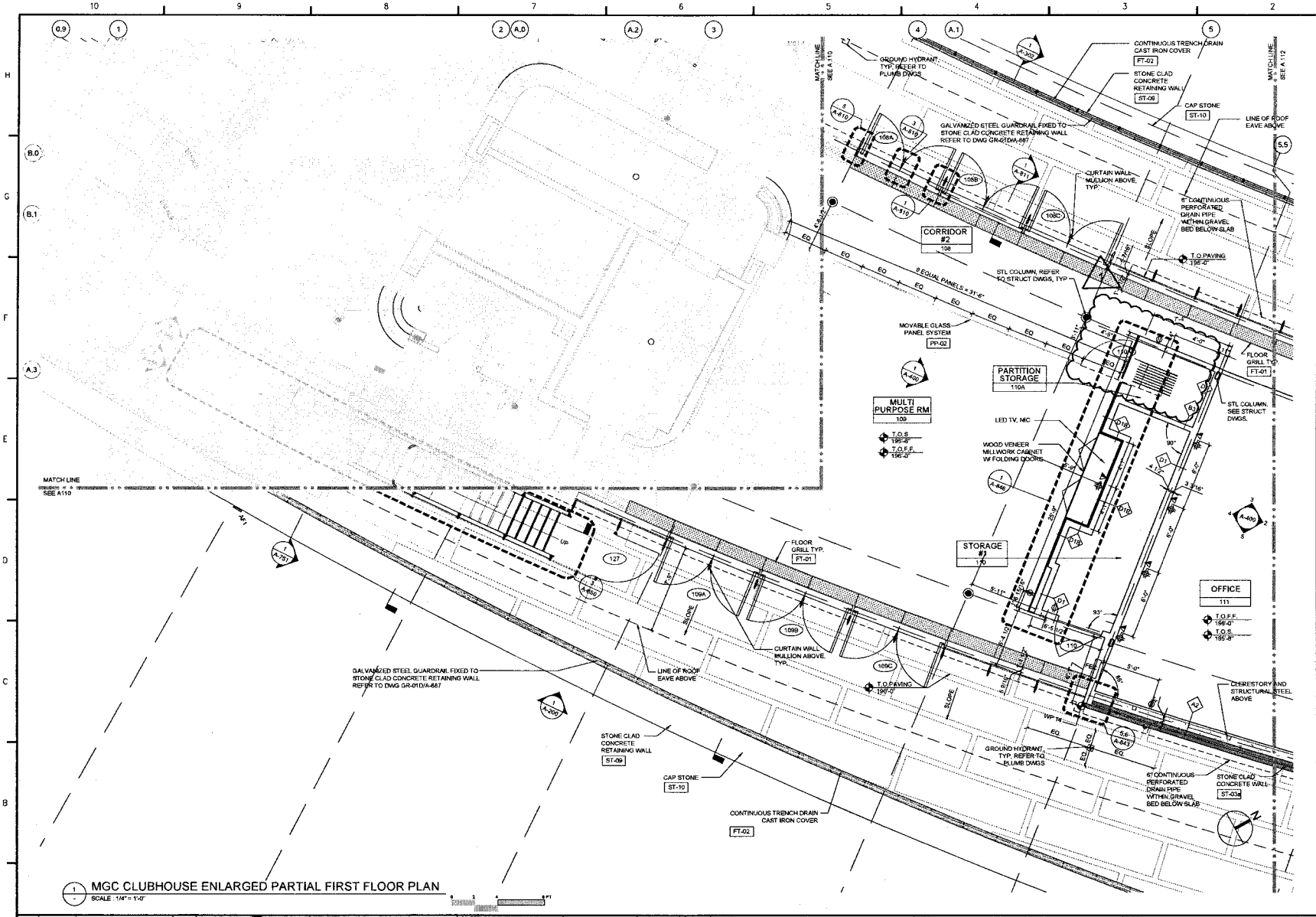
Attachment C
Addendum # 5
February 6, 2018

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT C – REVISIONS TO THE DRAWINGS

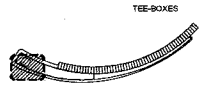
The following Drawing Sheet has been revised and is included with this Addendum:

DRAWING SHEET CROB_A_111 - Enlarged First Floor Plan 2 of 7



1 MGC CLUBHOUSE ENLARGED PARTIAL FIRST FLOOR PLAN
SCALE : 1/4" = 1'-0"

KEY PLAN



GENERAL NOTES

1. FOR COLUMN/ REFERENCE LINE LOCATIONS REFER TO BUILDING GEOMETRY DWG G-060
2. FOR W.P. LOCATIONS REFER TO BUILDING GEOMETRY DWG G-060
3. FOR PARTITION / WALL TYPE SCHEDULE REFER TO DWG A-900 & A-901
4. FOR DOOR / WINDOW SCHEDULE REFER TO DWG A-930
5. FOR ROOM FINISH SCHEDULE AND FINISHES, MATERIALS AND SYSTEMS LEGEND SEE DWG A-950
6. FOR CONCRETE WALL THICKNESS AND CONC. COLUMN SIZES REFER TO STRUCTURAL DWGS, TYP.
7. FOR EDGE OF FLOOR SLAB, TOP OF SLAB ELEVATION, SIZE AND LOCATION OF SLAB OPENINGS, REFER TO DWG G-061 AND G-062
8. FOR LIGHTING FIXTURE TYPE SCHEDULE REFER TO DWG G-097 AND SPECIFICATIONS
9. ELECTRICAL OUTLETITEL/DATA ARE SHOWN FOR LOCATION ONLY, REFER TO ELECTRICAL DWGS FOR ADDITIONAL INFORMATION.
10. DRYWALL PARTITION LOCATIONS SHOWN TO FACE OF GWB, TYP
11. REFER TO ELECTRICAL DWGS FOR CAFE/ KITCHEN EQUIPMENT CONNECTION / POWER/ TELDAT/ DATATAB DETAILS. ALL KITCHEN EQUIPMENTS ARE NOT IN CONTRACT.
13. REFER TO ELECTRICAL AND PLUMBING DWGS FOR EXT WALL PENETRATIONS REQUIRED BY INCOMING ELECT / PLUMB SERVICES
14. FOR POD LOCATION REFER TO DET. # 1/A-600
15. FOR FLOOR DRAINS, SEE PLUMBING DWGS & COORDINATE LOCATIONS WITH EQUIPMENT
16. COORDINATE PLYWOOD IN ELECTRICAL METER ROOM AS REQUIRED BY WALL MOUNTED WORK INSTALLATIONS
17. FOR GUARDRAIL TYPES REFER TO A-887

KEY

	DIRECTION OF SLOPE	FD	FLOOR DRAIN, TYP
RD	ROOF DRAIN, TYP		
	SLAB OPENING		OPENING IN SLAB ABOVE
(XX)	WALL MOUNTED DUPLEX (MOUNTING HT WHEN DIFFERENT FROM TYP)		
GFI	GROUND FAULT INTERRUPT DUPLEX		TELEPHONE AND DATA
	WALL MOUNTED QUAD	$	SWITCH

MATERIAL & FINISH LEGEND

CP-01	CARPET
GR-01	GALVANIZED STEEL / SST GUARDRAIL
FT-02	CAST IRON GRILL
ST-09	STONE MASONRY
ST-10	CAP STONE

NO.	DATE	ISSUED FOR	BY
1	02/02/18	ADDENDUM #5	GRIM

REGISTERED ARCHITECT ... STATE OF NEW YORK 10/20/17

CONSULTANTS

ARCHITECT
GRIMSHAW
637 West 27th Street
New York NY10001
T +1 646 293 3600
F +1 646 293 3610

NYC Environmental Protection

NYC Parks

PROJECT
PUBLIC BUILDINGS DIVISION
Croton Above Ground Structure and Landscaping - Phase B
3651 Jerome Avenue Bronx, NY 10467
Capital Project #: CRO-AGS

CLIENT
NYC DDC Department of Design and Construction

STATUS: Bid Set
DRAWING TITLE: ENLARGED FIRST FLOOR PLAN (2 of 7)

DATE: 11/15/17
SCALE: 1/4" = 1'-0"
DRAWN: MD
CHECKED: EJ
AUTHORIZED: DB
SHEET: CROB_A_111

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 12, 2018

ADDENDUM No. # 6

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **The Bid Opening for the contract described below scheduled for February 15, 2018, at 2:00 pm is rescheduled to March 1, 2018 at 2:00 pm.**

   Contract #1 – General Construction Work

2. **Bidders Questions and Responses to Questions:**
   See Attachment A.

3. **Revisions to the Drawings:**
   See Attachment B.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By:

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: March 1, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date; Bidders Questions and Responses to Questions		1/19/18		
#4 Bidders Questions and Responses to Questions; Revisions to the Drawings		2/2/18		
#5 Bidders Questions and Responses to Questions; Revisions to the Addendum to the General Conditions; Revisions to the Drawings		2/6/18		
#6 Revised Bid Opening Date; Bidders Questions and Responses to Questions; Revisions to the Drawings		2/12/18	AA	2/14

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 12, 2018

ADDENDUM No. # 6

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **The Bid Opening for the contract described below scheduled for February 15, 2018, at 2:00 pm is rescheduled to March 1, 2018 at 2:00 pm.**

   Contract #1 – General Construction Work

2. **Bidders Questions and Responses to Questions:**
   See Attachment A.

3. **Revisions to the Drawings:**
   See Attachment B.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

_____
Name of Bidder

By: _____

Attachment A
Addendum # 6
February 12, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	Are the audible and visible notification devices to be horns and strobes or speaker and strobes?	The audible and visible notification devices to be horns and strobes as noted in Specification Section 283111 'Digital, Addressable Fire-Alarm System,' Article 2.7E.
2	In the event of discrepancies in device quantities between the Floor Plans and the Riser Diagram, which quantity should the used for bidding?	In the event of discrepancies, Contractor to provide bid based on higher quantity listed on the Bid Documents.
3	In reference to Specification section 044020, "Exterior Stone Boulders," Article 1.6D (Stone Selection and Approval), who will pay for the Commissioner to visit the quarry and fabrication facility?	This expense shall be paid for by the City of NY and is not part of the Contract.
4	The model number for plumbing fixtures is not listed on drawings or within the specifications. Please advise.	Contractor to provide plumbing fixtures which adhere to the performance criteria and recommended manufacturers listed in Plumbing Specification sections 224213.13, 224213.16, 224216.13, 224216.16, 224223, 224500, and 224713.
5	Finish Schedule, CROB-A-950, calls for the west elevation of Corridor #1, Room # 107, to have 3 different finishes. Please provide an elevation for this wall in order to price the different finishes requested.	The west elevation of Corridor #1 will have finishes WD-08 and WD-09. Refer to revised POD EAST ELEVATION on CROB_A_603 and revised finish schedule CROB_A_950 included with Attachment B, Revisions to the Drawings.
6	Drawing CROB-C-112 references 'CB-7' on the Storm Drainage Chart. Please provide the location of CB-7.	All references to CB-7 shall be deemed deleted. See revised DWG CROB-C-112 included with Attachment B, Revisions to the Drawings, for clarification.
7	Note 2 in "Removals and Demolition-Civil Drawings" says that the NYCDEP will remove the existing fence and will replace it with jersey barrier on concrete barrier. The Contractor will be responsible of moving, reusing and removing the fence at the end of the project. What will happen with the concrete barrier? Will the NYCDEP remove it? Or will become the Contractor's property?	Concrete barrier will become property of the Contractor at the end of construction and shall to be removed by Contractor.
8	Is Atelier 10, the LEED consultant, fully responsible for collecting data and filing as required for LEED certification? What is the extent of the Contractor's involvement?	Yes, Atelier 10 is fully responsible for collecting data and filing as required for LEED certification. Contractor shall provide all support documentation as requested for filing.
9	Please confirm if both phases can be worked on simultaneously.	Yes, phase A and B can be worked on simultaneously.
10	Will the Contractor be taking responsibility of DDC/Liro trailers (with regards to rental, power, restrooms, supplies etc.)?	Yes.

11	Who will obtain the tree removal permits from DPR?	The Construction Manager (Liro) will be responsible for preparing the application. The Contractor will be responsible for pulling all required DPR permits.
12	What are the requirements for a security guard after hours?	Refer to the Addendum to General Conditions, Page 3, and General Conditions Section 015000, Sub-Section 3.18 (A-B) for this information.
13	Due to the large amount of unresolved questions and requests from our subcontractors we are kindly requesting a bid postponement of two weeks.	The Bid Opening Date will be March 1, 2018.
14	Where will the contractor pull all temp utilities from?	Temporary utilities can be pulled from existing ice House adjacent to Jerome avenue as shown on DWG DWG CROB_G_037.
15	Can the excavated material be reused for fill?	Contractor shall review Geotechnical Report and coordinate with the Geotechnical Engineer and Commissioner for re-use of on-site material.
16	Is the Contractor required to provide a new office trailer in addition to the existing office trailer indicated to remain on sheet CROA_G_032?	Yes. The Contractor is required to provide a new furnished onsite office trailer, as per Addendum to General Conditions, page 3, and General Conditions section 015000, Article 3.8(B-3b).
17	Please provide a lighting specification for LF-1 and the exit signs, as they are not shown on the Light Fixture Schedule.	Refer to Electrical drawing CROB_E_001, Electrical Symbol List: Control Nomenclature section for LF-1 and LF-1E. For information on exit signs, refer to Specification Section 265100 "Lighting Fixtures and Devices," Article 2.08.

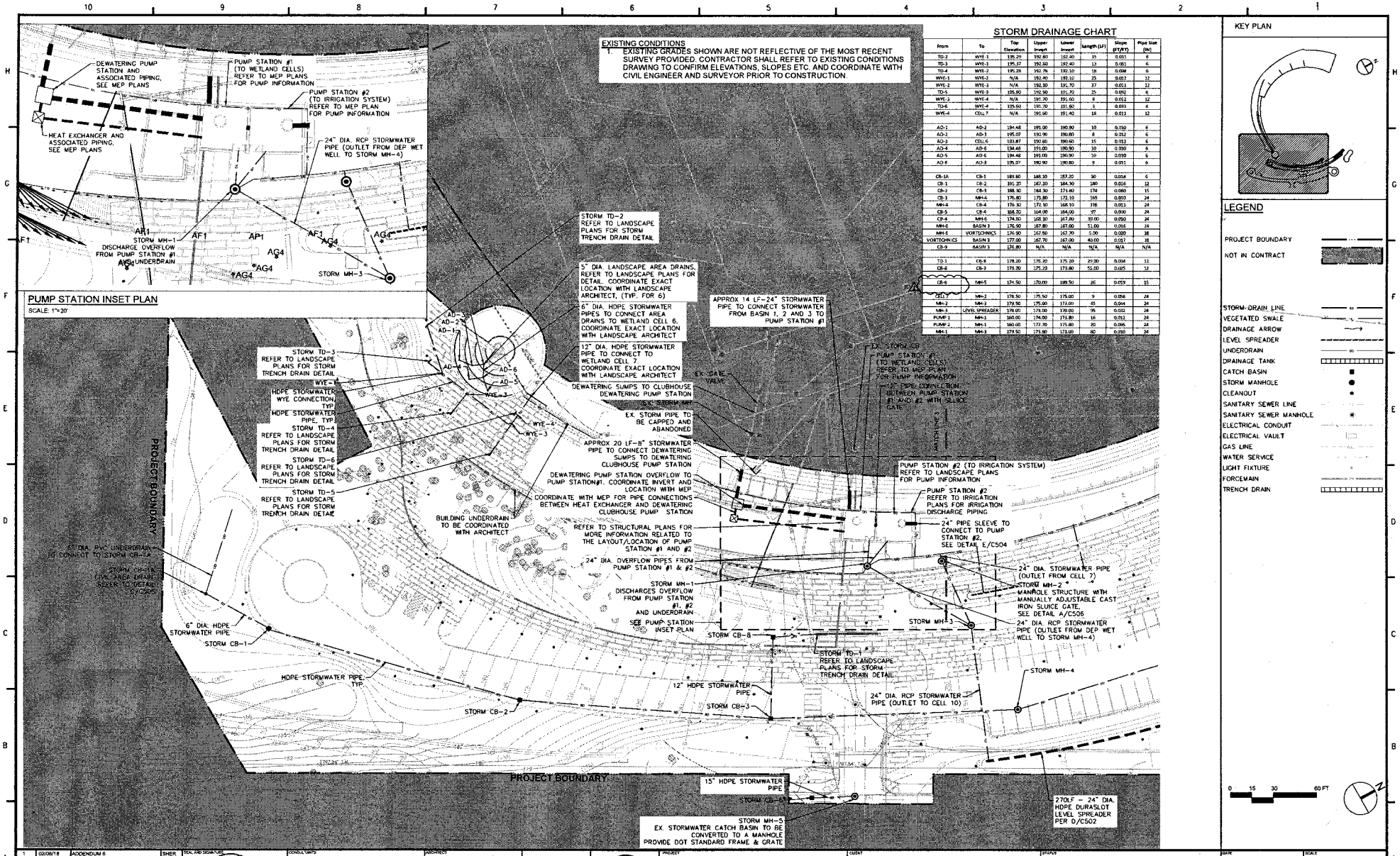
Attachment B
Addendum # 6
February 12, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT B – DRAWING REVISIONS

The following Drawing Sheets have been revised and are included with this Addendum:

1) CROB-A-603, POD- ELEVATIONS AND SECTIONS
2) CROB-A-950, ROOM FINISH /EQUIPMENT SCHEDULE
3) CROB-C-112, STORM DRAINAGE PLAN SHEET 1
4) CROB-C-113, STORM DRAINAGE PLAN SHEET 2



From	To	Top Elevation	Upper Invert	Lower Invert	Length (LF)	Slope (FT/FT)	Pipe Size (IN)
TD-2	WYE-1	195.29	192.60	192.40	35	0.005	6
TD-3	WYE-1	195.17	192.60	192.40	33	0.005	6
TD-4	WYE-2	195.28	192.76	192.10	18	0.038	6
WYE-1	WYE-2	N/A	192.40	192.10	25	0.012	12
WYE-2	WYE-3	N/A	192.30	191.70	37	0.016	12
TD-5	WYE-3	195.80	192.50	191.70	25	0.032	6
WYE-3	WYE-4	N/A	191.70	191.60	8	0.013	12
TD-6	WYE-4	195.93	191.70	191.60	5	0.020	6
WYE-4	CELL 7	N/A	191.60	191.40	18	0.011	12
AD-1	AD-2	194.48	191.00	190.90	10	0.010	6
AD-2	AD-3	195.07	190.90	190.80	8	0.012	6
AD-3	CELL 6	193.87	190.80	190.60	15	0.013	6
AD-4	AD-6	194.48	191.00	190.90	10	0.010	6
AD-5	AD-6	194.48	191.00	190.90	10	0.010	6
AD-6	AD-8	195.07	190.90	190.80	8	0.011	6
CB-1A	CB-1	189.80	188.10	187.20	90	0.010	6
CB-1	CB-2	190.20	187.30	184.90	240	0.010	12
CB-2	CB-3	188.30	184.30	173.80	174	0.060	15
CB-3	MH-4	176.80	173.80	172.10	169	0.010	24
MH-4	CB-4	176.30	172.10	168.10	398	0.010	24
CB-5	CB-4	168.30	164.00	164.00	97	0.000	24
CB-4	MH-6	174.30	168.30	167.80	30.00	0.010	24
MH-6	BASIN 3	176.90	167.80	167.00	51.00	0.016	24
MH-6	VORTECHNICS	176.90	167.80	167.70	5.00	0.020	18
VORTECHNICS	BASIN 3	177.00	167.70	167.00	40.00	0.017	18
CB-9	BASIN 3	176.80	N/A	N/A	N/A	N/A	N/A
TD-1	CB-8	178.20	176.20	175.20	29.00	0.034	12
CB-8	CB-3	179.30	175.20	173.80	55.00	0.025	12
CB-6	MH-5	174.50	170.00	169.50	26	0.019	15
CELL 7	MH-3	178.50	175.50	175.00	9	0.056	24
MH-2	MH-3	179.50	175.00	173.00	45	0.044	24
MH-3	LEVEL SPREADER	178.00	173.00	170.00	95	0.032	24
PUMP 1	MH-1	180.00	174.00	173.80	16	0.013	24
PUMP 2	MH-1	180.00	177.70	173.80	20	0.195	24
MH-1	MH-2	179.50	173.80	173.00	80	0.010	24

NO.	DATE	ISSUED FOR	BY
1	02/05/18	ADDENDUM 6	SHER

ARCHITECT
GRIMSHAW
637 West 27th Street
New York NY10001
T +1 646 293 3600
F +1 646 293 3610

Environmental Protection

NYC Parks

PROJECT
PUBLIC BUILDINGS DIVISION
Croton Above Ground Structure and Landscaping - Phase B
3651 Jerome Avenue Bronx, NY 10467
Capital Project #: CRO-AGS

CLIENT
Department of Design and Construction

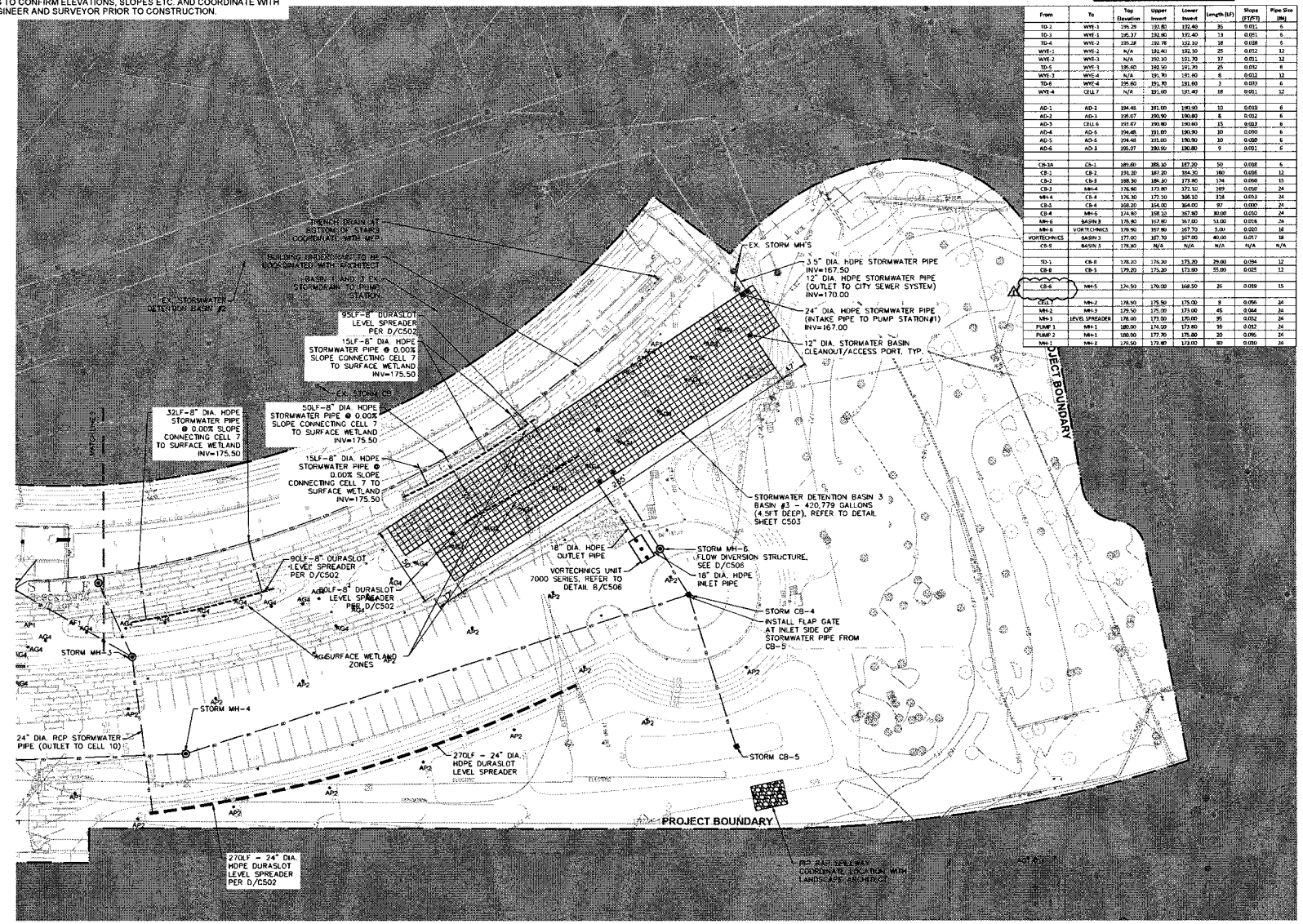
STATUS: Bid Set
DRAWING TITLE: STORM DRAINAGE PLAN SHEET 1

DATE: 11/15/17
SCALE: 1"=30'
DRAWN | CHECKED | AUTHORIZED

SHEET: C R O B C 1 1 2

EXISTING CONDITIONS

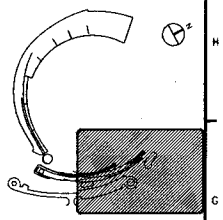
1. EXISTING GRADES SHOWN ARE NOT REFLECTIVE OF THE MOST RECENT SURVEY PROVIDED. CONTRACTOR SHALL REFER TO EXISTING CONDITIONS DRAWING TO CONFIRM ELEVATIONS, SLOPES ETC. AND COORDINATE WITH CIVIL ENGINEER AND SURVEYOR PRIOR TO CONSTRUCTION.



STORM DRAINAGE CHART

From	To	Top Elevation	Upper Invert	Lower Invert	Length (LF)	Slope (FT/FT)	Pipe Size (IN)
TD-2	WYE-1	195.29	192.80	192.40	35	0.011	6
TD-3	WYE-1	195.37	192.90	192.40	13	0.051	6
TD-4	WYE-2	195.28	192.78	192.10	18	0.038	6
WYE-1	WYE-2	N/A	192.40	192.10	25	0.012	12
WYE-2	WYE-3	N/A	192.10	191.70	37	0.011	12
TD-5	WYE-3	195.60	192.50	191.70	25	0.032	6
WYE-3	WYE-4	N/A	191.70	191.60	6	0.012	12
TD-6	WYE-4	195.60	191.70	191.60	3	0.033	6
WYE-4	CELL 7	N/A	191.60	191.40	18	0.011	12
AD-1	AD-3	194.48	191.00	190.90	10	0.010	6
AD-2	AD-3	191.07	190.90	190.80	6	0.012	6
AD-3	CELL 6	191.87	190.80	190.60	15	0.013	6
AD-4	AD-5	194.48	191.00	190.90	10	0.010	6
AD-5	AD-6	194.48	191.00	190.80	10	0.020	6
AD-6	AD-3	195.07	190.90	190.80	9	0.011	6
CB-1A	CB-1	189.60	188.10	187.20	50	0.018	6
CB-1	CB-2	191.20	187.20	184.30	180	0.016	12
CB-2	CB-3	188.30	184.30	173.80	174	0.060	15
CB-3	MH-4	176.80	173.80	171.10	269	0.010	24
MH-4	CB-8	176.30	171.10	168.10	218	0.013	24
CB-5	CB-4	168.20	164.00	164.00	97	0.000	24
CB-4	MH-6	174.80	168.20	167.60	80.00	0.050	24
MH-6	BASIN 3	176.80	167.80	167.00	53.00	0.015	24
MH-6	VORTECHNICS	176.90	167.80	167.70	5.00	0.020	18
VORTECHNICS	BASIN 3	177.00	167.70	167.00	40.00	0.017	18
CB-8	BASIN 3	176.80	N/A	N/A	N/A	N/A	N/A
TD-1	CB-8	178.20	176.20	175.20	29.00	0.034	12
CB-8	CB-3	179.20	175.20	173.80	55.00	0.025	12
CB-6	MH-5	174.50	170.00	168.50	26	0.039	15
CELL 7	MH-2	176.50	175.50	175.00	8	0.056	24
MH-2	MH-3	179.50	175.00	173.00	45	0.044	24
MH-3	LEVEL SPREADER	178.00	173.00	170.00	95	0.032	24
PUMP 1	MH-1	180.00	174.00	173.80	16	0.012	24
PUMP 2	MH-1	180.00	177.70	175.80	20	0.095	24
MH-1	MH-2	179.50	173.80	173.00	80	0.010	24

KEY PLAN



LEGEND

- PROJECT BOUNDARY
- NOT IN CONTRACT
- STORM DRAIN LINE
- VEGETATED SWALE
- DRAINAGE ARROW
- LEVEL SPREADER
- UNDERDRAIN
- DRAINAGE TANK
- CATCH BASIN
- STORM MANHOLE
- CLEANOUT
- SANITARY SEWER LINE
- SANITARY SEWER MANHOLE
- ELECTRICAL CONDUIT
- ELECTRICAL VAULT
- GAS LINE
- WATER SERVICE
- LIGHT FIXTURE
- FORCEMAIN
- TRENCH DRAIN

0 15 30 60 FT

NO.	DATE	ISSUED FOR	BY
1	02/05/18	ADDENDUM 6	SHER

SEAL AND SIGNATURE

CONSULTANTS

ARCHITECT
GRIMSHAW
637 West 27th Street
New York NY10001
T +1 646 293 3600
F +1 646 293 3610

NYC Environmental Protection

NYC Parks

PROJECT
PUBLIC BUILDINGS DIVISION
Croton Above Ground Structure and Landscaping - Phase B
3661 Jerome Avenue Bronx, NY 10467
Capital Project #: CRO-AGS

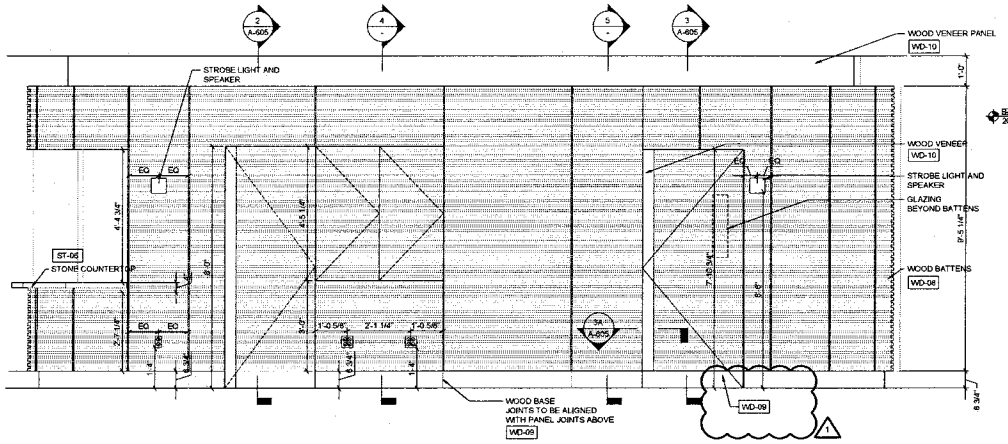
CLIENT
NYC DDC Department of Design and Construction

STATUS: Bid Set

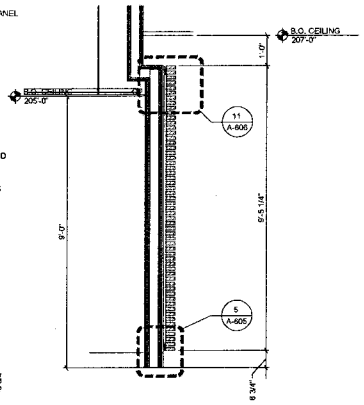
DRAWING TITLE: STORM DRAINAGE PLAN SHEET 2

DATE: 11/15/17
SCALE: 1"=30'
DRAWN | CHECKED | AUTHORIZED

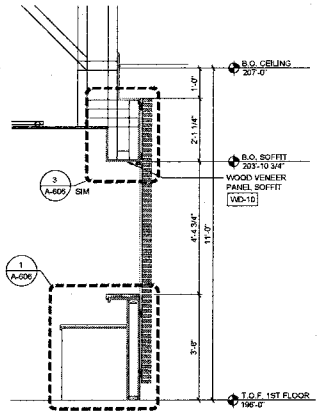
SHEET: C-ROB-C-111-3



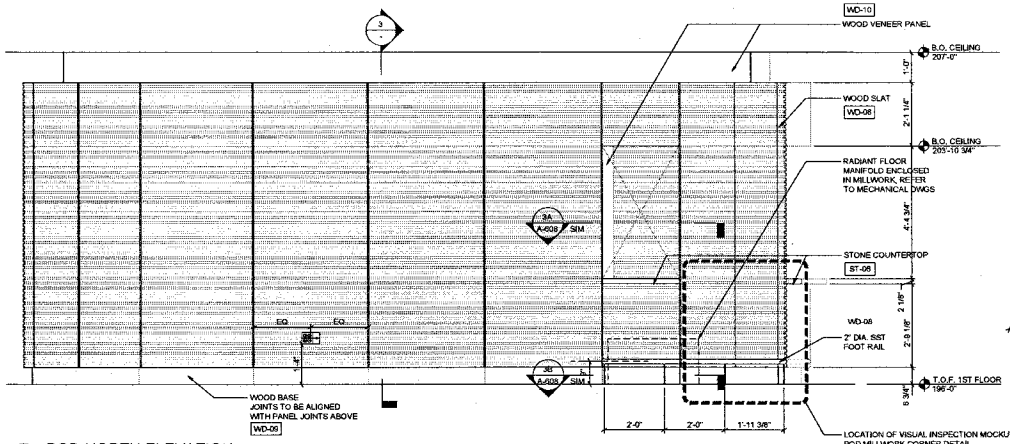
2 POD EAST ELEVATION
SCALE: 1/2" = 1'-0" REF. DWG A-600



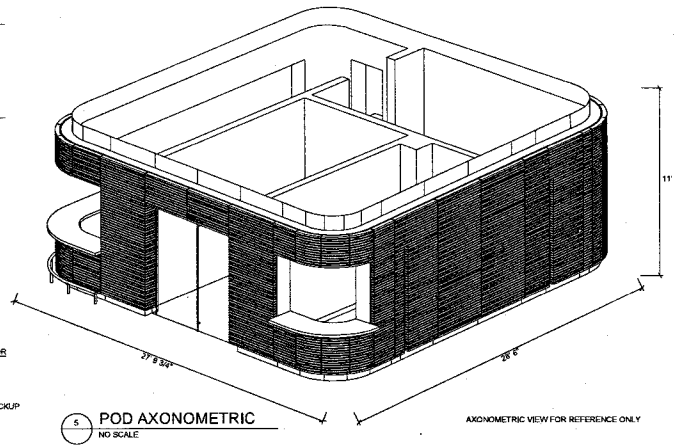
3 POD SECTION
SCALE: 1/2" = 1'-0" REF. DWG 8/A-604



4 POD SECTION THRU PRO-OFFICE
SCALE: 1/2" = 1'-0" REF. DWG 8/A-604



1 POD NORTH ELEVATION
SCALE: 1/2" = 1'-0" REF. DWG A-600



5 POD AXONOMETRIC
NO SCALE

AXONOMETRIC VIEW FOR REFERENCE ONLY

NO.	DATE	ISSUED FOR	BY
1	02/06/16	ADDENDUM 6	GRIM

SEAL AND SIGNATURE

CONSULTANTS

ARCHITECT
GRIMSHAW
637 West 27th Street
New York NY10001
T +1 646 293 3600
F +1 646 293 3610

NYC Environmental Protection

NYC Parks

PROJECT
PUBLIC BUILDINGS DIVISION
Croton Above Ground Structure and Landscaping - Phase B
3651 Jerome Avenue Bronx, NY 10467
Capital Project #: CRO-AGS

CLIENT
NYC DDC Department of Design and Construction

STATUS: Bid Set

DRAWING TITLE: POD ELEVATIONS AND SECTIONS

DATE: 11/15/17 SCALE: AS NOTED

DRAWN: CS CHECKED: EJ AUTHORIZED: DB

SHEET: CROB_A_603

CLUBHOUSE ROOM FINISH SCHEDULE

ROOM #	NAME	FLOOR TYPE	CLG FINISH	CLG HT (A.F.F.)	WALL NORTH		WALL EAST		WALL SOUTH		WALL WEST		REMARKS	ROOM #
					WALL FINISH	BASE FINISH	WALL FINISH	BASE FINISH	WALL FINISH	BASE FINISH	WALL FINISH	BASE FINISH		
BASEMENT														
B01	ELEC. METER ROOM	SC-01	BI-01	VARIES	SC-01	SC-01	SC-01	SC-01	PI-01	SC-01	PI-01	SC-01	-	B01
B02	GAS ROOM	SC-01	BI-01	VARIES	PI-01	SC-01	SC-01	SC-01	SC-01	SC-01	PI-01	SC-01	-	B02
B03	WATER METER ROOM	SC-01	BI-01	VARIES	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	PI-01	SC-01	-	B03
B04	STORAGE #4	SC-01	BI-01	VARIES	SC-01	SC-01	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01	-	B04
B05	STORAGE #5	SC-01	BI-01	VARIES	SC-01	PI-01	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01	-	B05
B06	MAINTENANCE ROOM	SC-01	BI-01	VARIES	-	-	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01	-	B06
B07	CART STORAGE	SC-01	BI-01	VARIES	SC-01	SC-01	PI-01	SC-01	SC-01	SC-01	PI-01	SC-01	-	B07
B08	SECURE GOLF BALL COLLECTION STORAGE	SC-01	BI-01	VARIES	PI-01	SC-01	PI-01	SC-01	SC-01	SC-01	PI-01	SC-01	-	B08
B09	RECYCLING AREA	SC-01	SC-01	VARIES	-	-	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	-	B09
B10	WETLAND CELL PUMP ROOM	SC-01	BI-02	VARIES	SC-01	SC-01	PI-01	SC-01	SC-01	SC-01	PI-01	SC-01	-	B10
B11	IRRIGATION PUMP ROOM	SC-01	BI-02	VARIES	PI-01	SC-01	PI-01	SC-01	SC-01	SC-01	PI-01	SC-01	-	B11
B12	WATER ROOM	SC-01	BI-02	VARIES	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01	SC-01	SC-01	-	B12
B13	BASEMENT ENTRANCE	SC-01	SC-01	VARIES	-	-	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	OUTDOOR	B13
B14	STAIR #3	SC-01	SC-01	VARIES	SC-01	SC-01	-	-	SC-01	SC-01	SC-01	SC-01	OUTDOOR	B14
121	STAIR #2	SC-01	SC-01	VARIES	SC-01	SC-01	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01		121
B15	STORAGE #5	SC-01	BI-01	VARIES	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01	PI-01	SC-01		B15
1ST FLOOR														
100	VESTIBULE #1	FT-01	PI-01	8'-0"	GL-07	GL-07	GL-04	GL-04	GL-07	GL-07	GL-04	GL-04	-	100
101	CAFE SEATING	ST-01/ST-02	WD-03	VARIES	VARIES, REF TO 1/A-602	VARIES, REF TO 1/A-602	GL-02	GL-02	GL-03	GL-03	GL-02	GL-02	-	101
103	PROSHOP	WD-11	CL-01	9'-0"	PI-01	WD-09	PI-01	WD-09	WD-10/ GL-06	WD-09	PI-01	WD-09	-	103
104	PRO OFFICE	WD-11	CL-01	9'-0"	PI-01	WD-09	PI-01	WD-09	PI-01	WD-09	PI-01	WD-09	-	104
105	CAFE	QT-01	CL-01	9'-0"	WD-10	WD-10	GL-09/WD-10	WD-10	WD-10	WD-10	WD-10	WD-10	-	105
106	KITCHEN	QT-01	CL-03	9'-0"	CT-01	CT-01	CT-01	CT-01	CT-01	CT-01	CT-01	CT-01	-	106
107	CORRIDOR #1	ST-01/ST-02	WD-03	VARIES	WD-10	WD-09	VARIES	VARIES	GL-03	GL-03	WD-08	WD-09	-	107
108	CORRIDOR #2	ST-01/ST-02	WD-03	VARIES	ST-04	ST-04	VARIES, REF TO 7/A-401	VARIES, REF TO 7/A-401	GL-03	GL-03	~~GL-02/GL-07~~	~~GL-02/GL-07~~	-	108
109	MULTIPURPOSE ROOM	ST-01/ST-02	WD-03	VARIES	WD-10	WD-09	PP-02	PP-02	VARIES, REF TO 1/A-603	VARIES, REF TO 1/A-603	GL-02/GL-07	GL-02/GL-07	-	109
110	STORAGE #1	SC-01	PI-01	9'-0"	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	-	110
110A	PARTITION STORAGE	SC-01	CL-01	9'-0"	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	-	110A
111	OFFICE	CP-01	CL-01/ CL-02	VARIES	PI-01	WD-09	PI-01	WD-09	PI-01	WD-09	PP-04	PP-04	-	111
112	CLOSET	CP-01	CL-01	9'-0"	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	-	112
113	STORAGE #2	SC-01	CL-01	9'-0"	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	-	113
114	IT CLOSET	SC-01	CL-01	9'-0"	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	-	114
115	VESTIBULE #2	FT-01/ ST-01/ ST-02	WD-03	VARIES	ST-04	ST-04	PI-01	WD-09	-	-	GL-02/GL-07	GL-02/GL-07	-	115
116	CORRIDOR #3	ST-01/ST-02	WD-03	9'-0"	PI-01	WD-09	PI-01	WD-09	PI-01	WD-09	-	-	-	116
117	WOMEN'S RESTROOM	PT-01	CL-01/ CL-02	VARIES	PT-02	PT-01	PT-02	PT-01	PT-02	PT-01	PT-02/GT-01	PT-01	-	117
118	MEN'S RESTROOM	PT-01	CL-01/ CL-02	VARIES	PT-02	PT-01	GT-01/ PT-02	PT-01	PT-02	PT-01	PT-02	PT-01	-	118
119	JANITOR CLOSET	SC-01	PI-01	9'-0"	PT-02	PT-01	PT-02	PT-01	PT-02	PT-01	PT-02	PT-01	-	119
120	STAFF SHOWER	PT-01	CL-02	9'-0"	PT-02	PT-01	PT-02	PT-01	PT-02	PT-01	PT-02	PT-01	-	120
121	STAIR # 2	SC-01	PI-01	9'-0"	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	PI-01	EXIT STAIR	121
122	LOCKER ROOM	CP-01	CL-01/ CL-02	VARIES	PI-01	WD-09	PI-01	WD-09	PI-01	WD-09	PI-01	WD-09	-	122
123	STORAGE #3	SC-01	SC-01	VARIES	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	-	123
124	MECHANICAL/ PLUMBING	SC-01	SC-01	VARIES	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	-	124
125	ELECTRICAL ROOM	SC-01	SC-01	VARIES	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	SC-01	-	125

GOLF EQUIPMENT

ITEM #	QTY.	EQUIPMENT LIST	BY	COMMENT
		GOLF EQUIPMENT		
07-01	1	BALL DISPENSER #1	CONTRACTOR	Range Servant ULTIMA-45
07-02	1	BALL DISPENSER #2	CONTRACTOR	Range Servant ULTIMA-18
07-03	3	BALL VENDING MACHINE ACCESSORIES	CONTRACTOR	TBD
07-04	1	BALL WASHER	CONTRACTOR	Range Servant BALL WASHER 1950
07-05	1	BALL ELEVATOR	CONTRACTOR	Range Servant Multi-Storey Elevator
07-06	1	CONNECTOR FOR TWO DISPENSER	CONTRACTOR	TBD
07-07	REFER TO DWGS	TEE BOX BALL COLLECTION NETTING	CONTRACTOR	Redden #550 Polyester Impact Netting System
08-01	113	LOCKER	BY OWNER	Contractor to provide filler panel as necessary
08-02	5	BENCH	BY OWNER	
	30	GOLF CARTS	BY OWNER	Club Car Precedent i2
	5	ELECTRIC MOWERS	BY OWNER	TBD by Concessionaire
	1	GOLF BALL COLLECTOR	BY OWNER	Club Car Precedent i2 with Ball Collection Attachment
	1	SEED SPREADER	BY OWNER	Hydraulic Vision Seed Spreader

INTERIOR

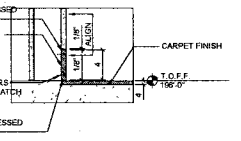
	REFER TO DWGS	WIRE MESH PARTITION	C	AMETCO STEEL SECURITY FENCE STADIUM DESIGN

MATERIALS AND SYSTEMS

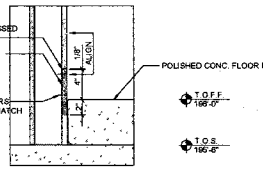
AESS-4	ARCH. EXPOSED STRUCTURAL STEEL GRADE
BI-01	BUILDING INSULATION
BI-02	ACOUSTICAL BUILDING INSULATION
BL-01	ROLLER SHADE
BL-03	ROLLER SHADE
CG-01	METAL CORNER GUARD
CL-01	GYPSUM BOARD CEILING
CL-02	ACOUSTICAL CEILING PANEL
CL-03	METAL PANEL CEILING
CR-01	CIP CONCRETE
CW-01	CURTAIN WALL
FB-01	TENSIONED FABRIC CANOPY SYSTEM
FT-01	SST GRILL
FT-02	CAST IRON GRILL
FT-03	CAST IRON GRILL
GA-01	GALVANIZED STEEL TREAD
GA-02	GALVANIZED STEEL GUARDRAIL
GA-03	GALVANIZED STEEL SAW GRATING
GA-04	GALVANIZED STEEL PIPE RAIL
GF-01	GFRC PANEL SYSTEM
GL-02	INSULATED GLASS UNIT (IGU)
GL-03	INSULATED GLASS UNIT (IGU)
GL-04	INSULATED GLASS UNIT (IGU)
GL-05	INSULATED GLASS UNIT (IGU)
GL-06	SAFETY GLAZING
GL-07	INSULATED GLASS UNIT (IGU)
GL-09	SAFETY GLAZING
GL-10	FULLY TEMPERED GLAZING
GR-01	GALVANIZED STEEL GUARDRAIL SYSTEM
GR-02	SST HANDRAIL
MF-01	SST COVER PLATES
MF-04	EXPANSION JT COVER
ML-01	METAL LOUVER
NP-01	NETTING POLES
OD-01	OVERHEAD COILING DOOR
OD-02	OVERHEAD COILING DOOR
PR-01	PLASTER ON EXTERIOR GRADE GWB
PP-01	METAL TOILET COMPARTMENT
PP-02	OPERABLE PARTITION
PP-03	WIRE MESH PARTITION
PP-04	GLAZED PARTITION
PV-01	CIP EXPOSED AGGREGATE PAVING
PV-02	CIP POROUS CONCRETE PAVING
PV-03	CIP CONCRETE
PV-04	ARCHITECTURAL PRECAST CONCRETE
RS-01	COMPOSITE SURFACING
ST-03a	STONE CLADDING
ST-03b	STONE CLADDING
ST-04	STONE CLADDING
ST-05	STONE MASONRY (SITE STONE)
ST-09	STONE MASONRY (SITE STONE)
ST-10	CAP STONE
WL-01	GYPSUM BOARD
WL-02	GYPSUM BOARD
WL-03	CEMENT BOARD
WM-02	STAINLESS STEEL WALK-OFF MAT WITH CARPET INSERT
WS-01	WEATHERING STEEL
07/07	NETTING

FINISHES

CP-01	CARPET
CT-01	CERAMIC WALL TILE
GT-01	GLASS MOSAIC WALL TILE
PE-01	PAINT PPG DURANAR XL SILVER SHADOW UD106707XL
PI-01	PAINT BENJAMIN MOORE OC-130 CLOUD WHITE
PL-01	PLASTIC LAMINATE
PL-02	PLASTIC LAMINATE
PT-01	CERAMIC FLOOR TILE
PT-02	CERAMIC WALL TILE
QT-01	QUARRY TILE
RT-01	RUBBER WALL BASE
SC-01	CONCRETE SEALER
SC-02	STONE FLOOR SEALER
SC-03	CONCRETE SEALER
ST-06	STONE CLADDING COUNTER
WD-03	WOOD VENEER PANEL CEILING SYSTEM
WD-06	CURTAIN WALL WOOD MULLION
WD-08	WOOD BATTEN
WD-09	WOOD WALL BASE
WD-10	WOOD VENEER PANEL
WD-11	WOOD FLOORING



2 WOOD BASE @ CARPET FLOOR FINISH
SCALE : 1 1/2" = 1'-0"



1 WOOD BASE @ CONC. FLOOR FINISH
SCALE : 1 1/2" = 1'-0"

NO.	DATE	ISSUED FOR	BY
1	02/08/18	ADDENDUM 8	GRIM

SEAL AND SIGNATURE — REGISTERED ARCHITECT — STATE OF NEW YORK — 10/20/17

CONSULTANTS

ARCHITECT
GRIMSHAW
637 West 27th Street
New York NY10001
T +1 646 293 3600
F +1 646 293 3610

NYC Environmental Protection

NYC Parks

PROJECT
PUBLIC BUILDINGS DIVISION
Croton Above Ground Structure and Landscaping - Phase B
3851 Jerome Avenue Bronx, NY 10467
Capital Project #: CRQ-AGS

CLIENT
Department of Design and Construction

STATUS	DATE	SCALE
Bid Set	11/15/17	NTS

DRAWING TITLE: ROOM FINISH/ EQUIPMENT SCHEDULE

DRAWN	CHECKED	AUTHORIZED
CS	EJ	DB

SHEET: C R O B _ A _ 9 5 0

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 20, 2018

ADDENDUM No. # 7

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Specifications:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By:

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: March 1, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date; Bidders Questions and Responses to Questions		1/19/18		
#4 Bidders Questions and Responses to Questions; Revisions to the Drawings		2/2/18		
#5 Bidders Questions and Responses to Questions; Revisions to the Addendum to the General Conditions; Revisions to the Drawings		2/6/18		
#6 Revised Bid Opening Date; Bidders Questions and Responses to Questions; Revisions to the Drawings		2/12/18		
#7 Bidders Questions and Responses to Questions; Revisions to the Specifications; Revisions to the Drawings		2/20/18	AD	2/22/18

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 20, 2018

ADDENDUM No. # 7

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Specifications:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

_____
Name of Bidder

By: _____

Attachment A
Addendum # 7
February 20, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	Please provide information for the thermally embedded graphic. This is not identified in Specification Section 101400 'Signage.'	Please refer to Attachment B, Revisions to the Specifications, for clarification.
2	Specification Section 283111 'Digital, Addressable Fire-Alarm System' calls for a printer, but no printer is indicated on the Contract Drawings. Is a printer required, and if so, what is the location?	Yes, a printer is to be provided as part of the Fire Alarm Control Panel located in Cart Storage Room 807. The system printer is an integral part of the Fire Alarm System and is located by the Fire Alarm Panel at Basement level. Please refer to Attachment B, Revisions to the Specifications, for clarification. Also refer to CROB_FA_102 in Attachment C, Revisions to the Drawings, for exact location.
3	Specified tiles PT-1 & PT-2 (from Specification Section 093000 'Ceramic Tile' have been discontinued. Please provide an alternate tile selection.	Refer to Attachment B, Revisions to the Specifications, for this information.
4	Please provide a detail for drainage/sewer pipe in trench installation.	Refer to CROB_C_508 for new detail for Sewer and Storm drain trench, included with Attachment C, Revisions to the Drawings.
5	Please advise on scope of the heat trace system.	Heat trace circuiting is indicated on the Electrical Drawings CROB_E_102 through CROB_E_120. Refer to other trade drawings and specifications for pipe runs and locations of additional heat-tracing.
6	Please advise on scope of incoming Con-ED service.	New 277/480V Con-Ed electrical connection to Electrical Meter Room in Clubhouse Basement. Contractor to co-ordinate with Con-Ed to provide new incoming service.
7	Please provide missing feeder tags on the riser diagram.	Feeder sizes are provided in the Panel Schedule for MDP on CROB-E-600. Fire alarm feed ¾"C #12CU conductors.
8	On Drawing A-212, there is a detail reference marker (3/A-848) that refers to a drawing that has not been provided. Please advise.	Refer to revised Drawing CROB_B_212, included with Attachment C, Revisions to the Drawings.
9	Light Fixtures AF4 & AF6 call to be Musco Lighting (or approved equal). Please provide a fixture model number/series.	AF6 is not part of this contract. AF4 to be pole mounted where there is no canopy. Refer to Attachment C, Revisions to the Drawings, for revised Lighting Schedule CROB_E_800.
10	Where in the Bid Set are the Structural Drawings for the cantilevered viewing platform?	Refer to plan Drawing 1 on CROB_S_110, Drawing 3 on CROB_S_423 and Slab schedule (6) on CROB_S_409 for this information.
11	The Structural Drawings- Phase B show a dark square in the legend that refers to cast in place concrete. Since the footings are not shaded, does this mean that they can be precast concrete?	No, the footings must be cast in place, not pre-cast, concrete. For clarity, see revised hatching in Key graphics in DWGS: CROB_S_090, CROB_S_091, CROB_ S_092, CROB_S_093, CROB_S_094, CROB_ S_095, CROB_S_096, CROB_S_097, COB_S_098, included with Attachment C, Revisions to the Drawings.

12	Some Structural drawings- Phase B (i.e. S303.00) reference a detail enlargement, 6/S404, for the connection between the exterior wall and the footing. Please clarify.	Reference 6/S404 (Drawing 6 on Sheet CROB_S_404) is the typical detail for a continuous wall footing. Where no slab on grade is present, i.e. at the footing shown on CROB_S_303, the slab shown is to be omitted as per revised note. The slab above will be connected per typical detail 2/CROB_S_404. Please refer to revised tags on drawings CROB_S_302, CROB_S_303, CROB_S304, CROB_S_305 and revised detail clarification on Drawing CROB_S_404, included with Attachment C, Revisions to the Drawings.

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT B – REVISIONS TO THE SPECIFICATIONS

Section 093000 Ceramic Tile

2.2 WALL TILE AND BASE

Replace Sub-section 2.2 A 3 with the following:

PT-02: Colari Series by Stone Source, Porcelain Tile, 2 inches by 2 inches, Flouro, Matte Finish White.

Or Roca Tile, CC Porcelain Unglazed Dot Mounted Porcelain, U272CC-12 12 x 12 mosaic of 2 x 2, Snow White

Or Daltile Key Stone, Arctic White D617, Unglazed 2x2

Or Approved equal

2.3 FLOOR TILE

Replace Sub-section 2.3 A with the following:

PT-01: Chromtech1.0 by Stone Source, Warm 4-Matte Porcelain Tile, 2 inches by 2 inches,

Or Roca Tile, CC Porcelain Unglazed Dot Mounted Porcelain, U272CC-12 12 x 12 mosaic of 2 x 2, Taupe
Non-slip to meet ADA requirements.

Or Daltile Key stone, D182 Suede Gray, Abrasive/Straight Joint 2x2
Non-slip to meet ADA requirements.

Or Approved equal

Section 101400 Signage

2.2 MATERIAL SUPPLIERS

Add F to Sub-section 2.2 Material Suppliers as follows:

F. Thermally embedded graphic fabrication to be provided by one of the following 3 fabricators, "Direct Embed Coating Systems LLC", "L&M Signs" or "Visual Graphic Systems" or approved equal.

Section 283111 Digital, Addressable Fire-Alarm System

2.3 FIRE ALARM CONTROL UNIT

Add c to Sub-section 2.3. A1 as follows:

c. The system printer is an integral part of the fire alarm system and is located immediately next to the fire alarm panel.

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT C – REVISIONS TO THE DRAWINGS

The following revised Drawing sheets are included with this Addendum:

CROB_FA_102	ELECTRICAL SYSTEMS
CROB_A_212	ENLARGED WEST ELEVATION
CROB_S_090	DPR CLUBHOUSE FOUNDATION PLAN-1
CROB_S_091	DPR CLUBHOUSE FOUNDATION PLAN-2
CROB_S_092	DPR CLUBHOUSE FOUNDATION PLAN-3
CROB_S_093	DPR CLUBHOUSE FOUNDATION PLAN-4
CROB_S_094	DPR CLUBHOUSE FOUNDATION PLAN-5
CROB_S_095	DPR CLUBHOUSE FOUNDATION PLAN-6
CROB_S_096	DPR CLUBHOUSE FOUNDATION PLAN-7
CROB_S_097	DPR CLUBHOUSE FOUNDATION PLAN-8
CROB_S_098	DPR CLUBHOUSE FOUNDATION PLAN-9
CROB_S_302	STRUCTURAL SECTION
CROB_S_303	STRUCTURAL SECTION
CROB_S_304	STRUCTURAL SECTION
CROB_S_305	STRUCTURAL SECTION
CROB_S_404	TYPICAL FOUNDATION DETAILS

The following additional Drawing sheet is included with this Addendum:

CROB_C_508	DETAILS VIII

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 26, 2018

ADDENDUM No. # 8

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Drawings:**
   See Attachment B.

3. **Additional Sketch:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Glenn Brue FOR B.P.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.

Name of Bidder

By:

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: March 1, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date; Bidders Questions and Responses to Questions		1/19/18		
#4 Bidders Questions and Responses to Questions; Revisions to the Drawings		2/2/18		
#5 Bidders Questions and Responses to Questions; Revisions to the Addendum to the General Conditions; Revisions to the Drawings		2/6/18		
#6 Revised Bid Opening Date; Bidders Questions and Responses to Questions; Revisions to the Drawings		2/12/18		
#7 Bidders Questions and Responses to Questions; Revisions to the Specifications; Revisions to the Drawings		2/20/18		
#8 Bidders Questions and Responses to Questions; Revisions to the Drawings; Additional Reference Sketch		02/26/18		

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 26, 2018

ADDENDUM No. # 8

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Drawings:**
   See Attachment B.

3. **Additional Sketch:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Glenn Brue FOR B.P.
Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

_____
Name of Bidder

By: _____

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 26, 2018

ADDENDUM No. # 8

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Drawings:**
   See Attachment B.

3. **Additional Sketch:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Glenn Brue FOR B.P.
Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

Name of Bidder

By: _____

Attachment A
Addendum # 8
February 26, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	In Phase B Civil Drawings-Storm Drainage and Sanitary Sewer Sheets. There are some pipes that are missing the material and/or diameter descriptions.	Please refer to Attachment B for revised material and/or diameter descriptions in civil drawings: CROB_L_0112, CROB_L_0113 and CROB_L_0122.
2	Specifications section 073360 – Vegetated Roofing System The specifications do not detail the precast pavers for the Pedestrian Path. The Contractor's bid breakdown form CSI number 073360 identifies the following item: 1 – Pedestrian Path at roof – precast pavers Are the pavers part of CSI item 073360 or 321400?	The pavers are part of CSI item 321400. Contractor to include pre-cast pavers under section 321400 of the Bid Breakdown form.
3	Specifications section 321400 – Unit Pavers The Contractor's bid breakdown form CSI number 321400 identifies the following: 1 – Precast concrete unit paving slabs, patio block, colors, 8"x16", 2 3/8" thick. The specifications under Part 2 Products, section 2.2 – concrete unit pavers identify a paver size of 4"x16"x 3.94". Please clarify the size of the paver. The Unit Price Schedule, item 24 calls for, Precast concrete unit paving slabs, patio block, colors, 8"x16", 2 3/8" thick, please confirm the size of the paver for this schedule.	The size of the pavers, per the spec section 2.2 is the 4 x 4 x 16 nominal paver. This is also shown on detail 1 LINEAR ROOF PAVERS on CROB_L-464.
4	Specifications section 044200 – Exterior Stone Cladding The Contractor's bid breakdown form CSI number 044200 identifies the following two items: 1 – Bluestone paving, smooth finish 2 – Bluestone wall base The specifications do not identify either of the above items, please provide a description for both and where they are to be installed. Unit Price Schedule item 10 calls for 232 sf of the 'bluestone paving, smooth finish, please provide a specification for the item and identify where it is to be installed.	The bluestone paving has been deleted from the project. Contractor to omit from Bid Breakdown.

5	The specifications, Part 2 Products, section 2.3, Edging at the Clubhouse Roof. The Contractor's Bid Breakdown Form doesn't have a line item for this, under what item is this work to be included? The specifications, Part 2 Products, section 2.4, Steel Landscaping Edging. The Contractor's Bid Breakdown Form doesn't have line item for this, under what item is this work to be included?	Contractor to include Section 2.3 and 2.4 to be included under "Green Roof" line item 073360 in the bid breakdown.
6	Specifications section 321400 – Unit Pavers The specifications, Part 2 Products, section 2.2, Concrete Unit Pavers identifies the following: B – Detectable Warning Paver The Contractor's Bid Breakdown Form doesn't have a line item for this, under what item is this work to be included?	Bid Breakdown form should include Detectable warning pavers under specification section 321400.
7	Is the signage included in this contract or is part of a different contract as specified in detail 2, drawing L-425, Phase B?	Yes, it is included. Please refer to Attachment B, DWG 2, CROB_L_425
8	The specs for the concrete weir walls in the Cast In Place concrete section, states that the concrete has to be pigmented but in there is a note in detail 3, drawings L-422 saying that the concrete has to be grey un-tinted. Which one is correct?	The Concrete is to be grey un-tinted as detailed in Attachment B, DWG 3, CROB-L-422.
9	We would like to suggest a change in detail 3, L-422 Ph. B and remove the Styrofoam from the weir wall footing. This element will impede the concrete to fill completely the bottom of the foundation when pouring and will compromise the structural integrity of such structure.	The Styrofoam is to be removed from the weir footing walls. Please refer to Attachment B, revised DWG CROB_ L422.
10	Does the slab on grade sit on stone base or on compacted subgrade? If it sits on stone base, what would be the thickness of this layer?	Refer to Detail 1B through 1F on DWG CROB_ L4_44 which shows Compacted Broken stone on top of compacted subgrade. The thickness of the Compacted broken stone is 2'.
11	Please provide the as-build drawings of the existing structures to be removed so we can accurately estimate this work.	Please refer to Attachment C, Figure 1 for as built drawings of existing structures to be removed.

Attachment B
Addendum # 8
February 26, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT B –

DRAWING REVISIONS

CROB_L_0112	STORM DRAINAGE PLAN SHEET 1
CROB_L_0113	STORM DRAINAGE PLAN SHEET 1
CROB_L_0122	SANITARY DRAINAGE PLAN SHEET 1
CROB_L_422	LEVEL CONCRETE WEIR WALL AND FOREBAY DETAILS
CROB_L_425	CELL 6 WALL DETAILS

Attachment C
Addendum # 8
February 26, 2018

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT C- SKETCHES

FIGURE 1 Package

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 27, 2018

ADDENDUM No. # 9

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Specifications:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Ann Bruce FOR B.P.
Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

C&L Contracting Corp.
Name of Bidder

By: _____

CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDA CONTROL SHEET

BID OPENING DATE: March 1, 2018

PROJECT No. : CRO-AGS

TITLE: Croton New Above Ground Structure and Landscaping

ADDENDA ISSUED	NO. OF DWG	DATE	APPROVED BY: ARCHITECTURE/ ENGINEERING	GENERAL COUNSEL
#1 Revisions to the Bid Booklet		1/9/18		
#2 Revisions to Volume 3		1/9/18		
#3 Revised Bid Opening Date; Bidders Questions and Responses to Questions		1/19/18		
#4 Bidders Questions and Responses to Questions; Revisions to the Drawings		2/2/18		
#5 Bidders Questions and Responses to Questions; Revisions to the Addendum to the General Conditions; Revisions to the Drawings		2/6/18		
#6 Revised Bid Opening Date; Bidders Questions and Responses to Questions; Revisions to the Drawings		2/12/18		
#7 Bidders Questions and Responses to Questions; Revisions to the Specifications; Revisions to the Drawings		2/20/18		
#8 Bidders Questions and Responses to Questions; Revisions to the Drawings; Additional Reference Sketch		02/26/18		
#9 Bidders Questions and Responses to Questions; Revision to Specifications; Revision to the Drawings.		02/27/18		

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 27, 2018

ADDENDUM No. # 9

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Specifications:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Alan Bruce FOR B.P.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

Name of Bidder

By: _____

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

February 27, 2018

ADDENDUM No. # 9

FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY AND REQUIRED FOR:

CRO-AGS
Croton New Above Ground Structure and Landscaping

This addendum is issued for the purpose of amending the requirements of the Bid and Contract Documents and is hereby made a part of said Bid and Contract Documents to the same extent as though it were originally included therein.

The bidder is advised that the items listed below apply to the project:

1. **Bidders Questions and Responses to Questions:**
   See Attachment A.

2. **Revisions to the Specifications:**
   See Attachment B.

3. **Revisions to the Drawings:**
   See Attachment C.

THIS ADDENDUM MUST BE SIGNED BY ALL BIDDERS AND ATTACHED TO THEIR BIDS.

If additional information is required, please contact the Department of Design and Construction, Contract Section at (718) 391-1016, by email at CSB_projectinquiries@ddc.nyc.gov or by fax at (718) 391-2627.

Glenn Bruce For B.P.

Bogdan Pestka, FAIA
Assistant Commissioner
Transportation, DEP and
Sanitation Programs

Name of Bidder

By: _____

Attachment A
Addendum # 9
February 27, 2018

DDC PROJECT #: CRO-AGS
PROJECT NAME: Croton New Above Ground Structure and Landscaping

ATTACHMENT A - BIDDERS QUESTIONS AND DDC RESPONSES

No.	Bidders Questions	DDC Responses
1	Temporary fence includes a temporary netting system to protect workers from stray golf balls. Please provide the requirements for this netting system, (i.e. pole type and height, sustainable force required for the netting, etc.) CROA-C-100 through C-102.	Temporary perimeter security fence should be completed with temporary netting poles and netting for the protection of workers. (see DWG CROA G_030). The particulars of the temporary netting system shall be determined by the contractor. The intent is to protect workers from errant golf balls from the neighboring Golf course and provision of the fence should be included in the Contractor's Safety Plan. The contractor shall determine the requirements of the temporary netting system including but not limited to calculating the strength, height, sustainable force necessary and size of openings in netting to comply with applicable NYC Building Code, NY State Code, OSHA. The temporary netting system shall be furnished and installed by the contractor
2	The specification 32 14 00, Part 2 Products, section 2.6, Concrete Sub-slab for Unit Pavers, where is this to be used? The specification 32 14 00, Part 2 Products, section 2.7, Mortar Setting Bed Materials, where is this to be used? The specification 32 14 00, Part 2 Products, section 2.8, Sealant, where is this to be used?	Refer to CROB_L_402, DWG 1 Detectable warning pavers for locations.
3	Please clarify if the existing fence will be removed and replaced by the NYCDEP within the entire site. Will the fence replacement be done before the project starts?	Contractor to confirm existing NYCDEP fence location, remove and relocate to construction and project boundaries. Please refer to DWG CROA G_030, DWG CROA G_031, CROB G_031, for existing fence removal requirements.
4	Is there a specific design for the temporary fence with temporary netting protection? Can the contractor use the existing concrete barriers to install this temporary netting on? What would be the height of this temporary net?	Refer to Addendum #9, RFI 1 response. It is acceptable for the contactor to use the existing concrete barriers provided DEP VIL security requirements are met.
5	Please provide specifications for lighting fixture AG4. It is not listed on the fixture schedule.	Refer to Attachment B: Figure 1 for lighting specification sheet for AG4 Device. Refer to Attachment B: Figure 1 for lighting specification sheet for AG4 Device. Lighting device to be provided by manufacturers Bega, KIM lighting, SIMES or approved equal.
6	Please confirm if the guards provided by the contractor need to be armed.	Refer to General conditions 0150 00-26 Subsection 3.18 for specific requirements for guards.

7	Drawing CROB_A_950 – Room Finish/Equipment Schedule identifies the following finishes for the 1st Floor Schedule: ST-01 ST-02 ST-04 These finishes are identified for the following rooms: 101 – Café Seating 107 – Corridor #1 108 – Corridor #2 115 – Vestibule #2 116 – Corridor #3 Please provide description for each finish and identify within each room where finishes are to be installed.	ST-01, ST-02 bluestone paving has been deleted from the project.] Refer to DWG CROB_A_112 which shows ST-04 located on the north wall of Corridor 2.
8	On drawing S-000, note 19 specifies that the contractor's engineer designs shall be prepared, signed, and sealed by a licensed professional engineer in the state of Pennsylvania. Is this correct?	Drawing CROA_S_000 Refer to attachment, incorrectly states. "Contractors engineered designs shall be prepared signed and sealed by a licensed professional engineer in the state of Pennsylvania and submitted to engineer of record for review." Refer to attachment B for revised CROA_S_000 Drawing CROB_S-000, note 19 correctly states: *"Contractors engineered designs shall be prepared signed and sealed by a licensed professional engineer in the state of New York and submitted to Commissioner for review."*
9	For the sake of maintaining consistency with the adjacent building's stone veneer and other features, we request the name of the contractor who built that structure in the Mosholu Course.	SKANSKA was the General Contractor and "NY QUARRIES" supplied the stone veneer for the built DEP facilities on the Mosholu site.
10.	Addendum #7, Bidders Q&A #9 indicates that drawing CROB_E_800 will be replace in this addendum, and to see Attachment C. Attachment C does not indicate a revised drawing and no revised drawing was included in the drawing download. Please provide this revised drawing (CROB_E_800)	See revised drawing sheet CROB_E_800 attached to this addendum.

Attachment B
Addendum # 9
February 17, 2018

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT B – Revision to Specifications

Figure 1: AG4 Lighting Specification Sheet.

Attachment C
Addendum # 9
February 27, 2018

DDC PROJECT #: **CRO-AGS**
PROJECT NAME: **Croton New Above Ground Structure and Landscaping**

ATTACHMENT C – Revisions to the Drawings

CROA S_000

CROB_E_800

GENERAL NOTES:

1. THE PROJECT SHALL CONFORM TO THE 1968 NEW YOR CITY BUILDING CODE (66) INCLUDING AMENDMENTS AND ALL FOLLOWING REFERENCE STANDARDS
   - A. ASCE-7 2005 MINIMUM DESIGN LOADS FOR BUILDINGS AND STRUCTURES
   - B. ACI-318 2008, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
   - C. ACI 530-08, BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES
   - D. AISC MANUAL OF STEEL CONSTRUCTION, LATEST EDITION
   - E. AISC 360-05 SPECIFICATIONS FOR STEEL BUILDINGS
   - F. AWS D1.1-04, STRUCTURAL WELDING CODE - STEEL
   - G. ASCE 55-10 TENSILE MEMBRANE STRUCTURES - FABRIC
2. ALL STRUCTURAL WORK SHALL CONFORM TO THE PROJECT SPECIFICATIONS, ALL DRAWINGS AND APPLICABLE REFERENCE STANDARDS. THE SCOPE OF WORK IS NOT SOLELY DEFINED BY THESE DRAWINGS.
3. THE FOLLOWING DOCUMENTS ARE TO BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND THE DESIGN DRAWINGS, AS LISTED, BELOW
   - A. GEOTECHNICAL INVESTIGATION REPORT BY "CROTON WATER TREATMENT PLAN. GEOTECHNICAL DESIGN REPORT MOSHOLU GOLF COURSE", PREPARED FOR AECOM/AZEN & SAWYER JV
4. TYPICAL DETAILS APPLY THROUGHOUT THE PROJECT, EVEN IF NOT SPECIFICALLY REFERENCED IN PLANS OR DETAILS. DETAILS OF CONSTRUCTION NOT FULLY SHOWN OR NOTED ON THE DRAWINGS NON CALLED OUT IN THE SPECIFICATIONS SHALL BE OF THE SAME SIZE AND CHARACTER AS FOR SIMILAR CONDITIONS WHICH ARE SHOWN AND NOTED.
5. ALL FORCES INDICATED IN THE STRUCTURAL DRAWINGS ARE ALLOWABLE LOADS AS DEFINED BY AGCE 7, UNLESS NOTED OTHERWISE.
6. DO NOT USE DIMENSIONS SHOWN ON THE STRUCTURAL DWGS. WHERE DIMENSION IS PROVIDED OR A DISCREPANCY EXISTS, CONSULT THE ARCHITECT FOR VERIFICATION BEFORE PROCEEDING WITH WORK.
7. SEE ARCHITECTURAL DRAWINGS FOR SITE POSITIONING AND PROJECT DATUM REFERENCE, FLOOR ELEVATIONS AND GRID DIMENSIONS.
8. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF PERSONS AND PROPERTY AND THE MEANS AND METHODS OF CONSTRUCTION.
9. STRUCTURAL ELEMENTS SHALL BE CENTERED ON GRIDLINES OR DIMENSION LINES, UNLESS OTHERWISE NOTED.
10. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE UNTIL THE CONSTRUCTION OF THE STRUCTURE REACHES ITS FINAL CONDITION.
11. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE DESIGN, INSTALLATION, AND REMOVAL OF TEMPORARY BRACING AND CONSTRUCTION SUPPORTS, FOR NEW AND EXISTING STRUCTURES, AS NECESSARY TO COMPLETE THE PROJECT. NO PORTION OF THE PROJECT WHILE UNDER CONSTRUCTION IS INTENDED TO BE STABLE IN THE ABSENCE OF THE CONTRACTOR'S TEMPORARY SUPPORTS AND BRACES. CONTRACTOR SHALL RETAIN A STRUCTURAL ENGINEER LICENSED IN THE STATE IN WHICH THE PROJECT IS LOCATED TO DESIGN TEMPORARY BRACING AND CONSTRUCTION SUPPORTS.
12. THE CONTRACTOR IS RESPONSIBLE TO COORDINATE ALL STRUCTURAL WORK WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING, AND OTHER TRADES REQUIREMENTS. REFER TO ARCHITECTURAL DRAWINGS FOR THE DIMENSIONS NOT SHOWN ON PLAN. DISCREPANCIES AND/OR INTERFERENCES SHALL BE REPORTED TO THE ARCHITECT IMMEDIATELY.
13. DIMENSIONS AND DETAILS OF EXISTING CONSTRUCTION GIVEN IN STRUCTURAL DRAWINGS ARE APPROXIMATE AND ARE BASED ON LIMITED INFORMATION. THE CONTRACTOR SHALL VERIFY ALL INFORMATION PERTAINING TO EXISTING CONDITIONS BY ACTUAL MEASUREMENT AND OBSERVATION AT THE SITE. ALL DISCREPANCIES BETWEEN ACTUAL CONDITIONS AND THOSE SHOWN IN THE CONTRACT DOCUMENTS SHALL BE REPORTED TO THE ARCHITECT FOR EVALUATION PRIOR TO SHOP DRAWING SUBMITTALS.
14. CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ENGINEERED DESIGNS AND COORDINATION OF FINAL SUPPORT DETAILS OF NON-STRUCTURAL ITEMS IDENTIFIED IN CONTRACT DOCUMENTS INCLUDING, BUT NOT LIMITED TO:
   - A. ELEVATORS, ESCALATORS
   - B. PREFABRICATED STAIRS
   - C. MECHANICAL EQUIPMENT ATTACHMENTS AND DUNNAGE SUPPORT
   - D. FACADES
   - E. STEEL AT INTERMEDIATE LANDINGS OF STAIRS AND ANY HANGERS REQUIRED TO SUPPORT INTERMEDIATE LANDING IS BY STAIR CONTRACTOR UNLESS OTHERWISE NOTED ON DRAWINGS.
15. OPENINGS SHALL NOT BE MADE IN ANY STRUCTURAL MEMBER UNLESS SPECIFICALLY SHOWN ON THE STRUCTURAL DRAWINGS OR APPROVED BY THE STRUCTURAL ENGINEER.
16. DEFICIENT WORK AND WORK NOT IN CONFORMANCE WITH THE CONTRACT DOCUMENTS AS IDENTIFIED BY THE ARCHITECT OR INSPECTOR SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. CONTRACTOR SHALL COMPENSATE OWNER FOR SERVICES ARISING FROM DEFICIENT WORK.
17. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ANY REQUIRED DEWATERING OF THE SITE DURING CONSTRUCTION.
18. THE CONTRACTOR SHALL PREPARED ENGINEERED DESIGN AND SHALL BE RESPONSIBLE FOR CONFIRMING ADEQUACY OF AS BUILT STRUCTURE FOR ALL SURCHARGE LOADS RESULTING FROM CONSTRUCTION AS WELL AS CRANES, TRUCKS, BULLDOZERS OR ANY OTHER CONSTRUCTION EQUIPMENT.
19. CONTRACTOR'S ENGINEERED DESIGNS SHALL BE PREPARED, SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER IN THE STATE OF NEW YORK AND SUBMITTED TO ENGINEER OF RECORD FOR REVIEW.
20. CONNECTIONS OF SYSTEMS DESIGNED BY CONTRACTOR'S ENGINEER SUCH AS, BUT NOT LIMITED TO, CLADDING, STAIRS, ELEVATORS, ESCALATORS, AND MEP LOADS ARE ASSUMED TO IMPOSE VERTICAL AND/OR HORIZONTAL LOADS ON THE BASE BUILDING STRUCTURAL MEMBERS WITHOUT GENERATING TORSION IN THE SUPPORTING STRUCTURAL MEMBERS. CONTRACTOR IS RESPONSIBLE FOR FURNISHING AND INSTALLING ALL SUPPLEMENTARY BRACING MEMBERS AS REQUIRED TO PREVENT TORSION ON THE BASE BUILDING STRUCTURE.
21. IN ANY CASE OF CONFLICT BETWEEN DRAWINGS, DETAILS, NOTES OR SPECIFICATIONS, THE MOST RIGID REQUIREMENTS SHALL GOVERN. CONTRACTOR SHALL MAKE NO DEVIATION FROM THE CONTRACT DOCUMENTS WITHOUT PRIOR WRITTEN APPROVAL FROM THE STRUCTURAL ENGINEER AND ARCHITECT.
22. THE CONTRACTOR SHALL PROTECT EXISTING FACILITIES, STRUCTURES, AND UTILITY LINES FROM ALL DAMAGE.
23. JOB SAFETY AND CONSTRUCTION PROCEDURES ARE THE RESPONSIBILITY OF THE CONTRACTOR.

INSPECTIONS (NYC BC 1998):

SPECIAL INSPECTIONS IN ACCORDANCE WITH NYC BC 1968 AND THE CITY OF NEW YORK SHALL BE PERFORMED BY APPROVED TESTING AGENCIES RETAINED BY THE OWNER AT NO COST TO THE CONTRACTOR FOR THE FOLLOWING ITEMS SEE THE SPECIFICATIONS FOR SCOPE AND FREQUENCY OR AS MINIMUM PER REFERENCED STANDARDS.

1. STRUCTURAL LOAD-BEARING MEMBERS OR ASSEMBLIES PRE-FABRICATED ON SHOP PREMISES IF FABRICATOR NOT REGISTERED AND APPROVED (1704.2.1)
2. STEEL CONSTRUCTION INCLUDING: (1704.3)
   - A. MEMBER MATERIAL VERIFICATION
   - B. HIGH STRENGTH BOLTING
   - C. WELDING
   - D. STEEL FRAME DETAILS (BRACING, STIFFENING, MEMBER LOCATIONS, AND CONNECTIONS)
3. CONCRETE CONSTRUCTION INCLUDING: (1704.4)
   - A. REINFORCEMENT MATERIAL, WELDING, BAR RADII AND PLACEMENT
   - B. ANCHOR BOLTING
   - C. DESIGN MIX
   - D. PLACEMENT/ERECTION
   - E. STRENGTH
   - F. CURING TEMPERATURE AND TECHNIQUES
   - G. PRESTRESSING
4. MASONRY CONSTRUCTION: (1704.5)
   - A. PREPARATION OF MORTAR AND MORTAR JOINTS
   - B. REINFORCEMENT AND CONNECTORS
   - C. ANCHORAGE
   - D. PROTECTION FROM COLD AND HOT WEATHER
   - E. GROUTING
   - F. PRESTRESSING
5. WOOD CONSTRUCTION INCLUDING: (1704.5)
   - A. PREFABRICATED WOOD STRUCTURES
   - B. FABRICATED HIGH LOAD DIAPHRAGMS
     - I. CONNECTION DETAILS
     - II. PANEL SHEATHING
     - III. NOMINAL SIZE OF FRAMING MEMBERS
6. SOILS (1704.7)
   - A. SITE PREPARATION
   - B. FILL PLACEMENT AND COMPACTION
   - C. IN-PLACE DRY DENSITY OF COMPACTED FILL
7. QUALITY ASSURANCE PLAN FOR SEISMIC RESISTANCE AND SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE (1705-7)
8. QUALITY ASSURANCE PLAN FOR WIND REQUIREMENTS AND SPECIAL INSPECTIONS FOR WIND REQUIREMENTS (1706)
9. STRUCTURAL TESTING FOR SEISMIC RESISTANCE (1708)
10. SPECIAL TESTING REQUIREMENTS
    - A. DESIGN STRENGTH OF MATERIALS (1710)
    - B. ALTERNATIVE TEST PROCEDURE (1711)
    - C. TEST SAFE LOAD (1712)
    - D. IN-SITU LOAD TESTS (1713)
    - E. PRECONSTRUCTION LOAD TESTS (1714)
      - I. WALL AND PARTITION ASSEMBLIES
      - II. EXTERIOR WINDOW AND DOOR ASSEMBLIES
    - F. MATERIAL AND TEST STANDARDS (1715)
      - I. JOIST HANGERS
      - II. ROOF TILES

FOUNDATIONS:

1. ALL FOUNDATIONS SHALL REST ON SUBGRADE CONDITIONS SUITABLE FOR THE IDENTIFIED BEARING CAPACITY. ADEQUACY OF BEARING STRATUM SHALL BE VERIFIED IN THE FIELD BY THE GEOTECHNICAL ENGINEER OR SPECIAL INSPECTOR PRIOR TO INSTALLING FOUNDATIONS. ADJUST BOTTOM OF FOUNDATION ELEVATIONS AS REQUIRED TO ACHIEVE THE REQUIRED BEARING CAPACITY.
2. SOIL PREPARATION OF THE SITE SHALL FOLLOW THE RECOMMENDATIONS DESCRIBED IN THE GEOTECHNICAL REPORT. THIS INCLUDES REMOVAL OF EXISTING STRUCTURES /UTILITIES; REMOVAL OF EXISTING FILL WHERE DEEMED NECESSARY; PREPARATION OF THE SUBGRADE & COMPACTION; EXCAVATIONS FOR NEW FOUNDATIONS & SLABS; AND BACKFILLING TO RETAINING WALLS.
3. WHERE SOIL CONDITIONS ARE FOUND DURING CONSTRUCTION THAT DO NOT MEET CRITERIA DESCRIBED IN THE REPORT, SPECIAL INSPECTOR/CONTRACTOR SHALL NOTIFY ARCHITECT IMMEDIATELY.
4. LOCATION OF ALL UNDERGROUND UTILITIES SHALL BE VERIFIED PRIOR TO CONSTRUCTION OF FOUNDATION TO AVOID ANY INTERFERENCE. CONTRACTOR SHALL EXPOSE EXISTING UTILITY LINES IN THE IMMEDIATE AREA TO DETERMINE THEIR EXACT INVERT ELEVATION, SIZE AND LOCATION RELATIVE TO THE FOUNDATION. NOTIFY THE ENGINEER IMMEDIATELY OF ANY INTERFERENCE WITH FOOTINGS OR THE FOUNDATION WALL.
5. DO NOT PLACE BACKFILL AGAINST BASEMENT /PROPPED RETAINING WALLS UNTIL ALL FLOOR SLABS AND OTHER STRUCTURES BRACING THESE WALLS ARE IN PLACE AND ALL WALLS AND BRACING STRUCTURES HAVE ACHIEVED DESIGN STRENGTH.
6. DO NOT UNDERMINE CONSTRUCTED FOUNDATIONS WITHIN THE AREA OF INFLUENCE WITHOUT SHORING OR UNDERPINNING. THE INFLUENCE LINE SHALL EXTEND FROM THE BOTTOM OF FOUNDATIONS, ELEVATOR PIT SLABS, AND SUMP PITS ETC AT THE SLOPE STATED IN THE GEOTECHNICAL REPORT.
7. WATER SHALL NOT BE ALLOWED TO STAND IN TRENCHES OR FORMS BEFORE OR AFTER CONCRETE IS PLACED, AND SHALL BE PUMPED OUT. IF BOTTOMS OF TRENCHES BECOME SOFTENED DUE TO RAIN OR OTHER WATER BEFORE FOUNDATIONS ARE CAST, THE CONTRACTOR SHALL, AT THEIR OWN EXPENSE, EXCAVATE THE SOFTENED MATERIAL AND REPLACE WITH CONCRETE.

REINFORCED CONCRETE:

1. ALL CONCRETE SHALL HAVE THE FOLLOWING ULTIMATE COMPRESSIVE STRENGTH AT 28 DAYS MADE WITH NORMAL WEIGHT (STONE) AGGREGATE (ASTM C33) UNLESS OTHERWISE NOTED, REFER TO SPECIFICATIONS FOR MIX REQUIREMENTS.
   - A. SIDEWALKS AND CART STORAGE — 4000 PSI AIR -ENTRAINED STONE*
   - B. SLABS ON GRADE (UON) — 4000 PSI STONE*
   - C. FLOWABLE FILL — 500 PSI*
   - D. EXTERIOR CONCRETE WALLS — 4000 PSI STONE
   - E. CONCRETE ON METAL DECK — 4000 PSI LIGHTWEIGHT (100 PCF)
   - F. INTERIOR CONCRETE WALLS AND ALL OTHER CONCRETE — 4000 PSI STONE
   - G. RETAINING WALLS — 6000 PSI STONE
   - H. WALL ALONG GRID LINES A.1 AND C.1 BET COL LINE 22 AND 65 — 4000 PSI STONE
   - I. STRUCTURAL PRECAST — 6000 PSI LIGHTWAIGHT (110 PCF)
   - J. ARCHITECTURAL PRECAST — 4000 PSI LIGHTWAIGHT (100 PCF)

   *RECYCLED AGGREGATE
2. LIGHTWEIGHT AGGREGATE SHALL CONFORM TO ASTM C330.
3. ALL CONCRETE NOT IN CONTACT WITH EARTH TO HAVE FINISH AS SPECIFIED BY ARCHITECT OR AS COVERED IN PROJECT SPECIFICATIONS. UNLESS OTHERWISE NOTED, NON ARCHITECTURAL CONCRETE COLUMNS AND WALLS SHALL HAVE ¾" CHAMFERED CORNERS.
4. ALL CAST-IN-PLACE CONCRETE WILL EXPERIENCE DIFFERING VARIATIONS OF CRACKING. ANY ELEMENT EXPOSED TO DIRECT WEATHER AND/OR TEMPERATURE VARIATIONS DURING CONSTRUCTION OR IN THE FINAL CONDITION IS TO BE TREATED AND REGULARLY MAINTAINED TO PREVENT PROPAGATION OF CRACKS AND WATER PENETRATION. THE CONTRACTOR SHALL DEVELOP A REGULAR MAINTENANCE PROGRAM AND SUBMIT IT TO THE OWNER.
5. ALL SLABS SHALL BE FLAT AND LEVEL PER THE CONCRETE SPECIFICATIONS. THE CONCRETE CONTRACTOR SHALL INCLUDE IN THEIR BID ANY EXCESS CONCRETE REQUIRED DUE TO SUPPORT MEMBER DEFLECTION TO POUR SLABS FLAT AND LEVEL. THE CONCRETE PLACING PROCEDURE SHALL BE CONTROLLED TO MINIMIZE SUPPORT MEMBER DEFLECTION.
6. ALL ADJOINING SURFACES NOT CAST MONOLITHICALLY SHALL BE ROUGHENED TO 1/4 INCH AMPLITUDE FOR THE ENTIRE INTERSECTING SURFACE ACCORDING TO ACI RECOMMENDATIONS AND APPLY A BONDING AGENT.
7. ALL CONCRETE SHALL BE REINFORCED. PROVIDE MINIMUM TEMPERATURE REINFORCEMENT AS REQUIRED BY ACI-318 IN ELEMENTS WHERE NO REINFORCEMENT IS INDICATED ON THE DRAWINGS.
8. MINIMUM CLR COVER FOR REINFORCING STEEL SHALL BE 3/4" FOR INTERIOR SLABS AND INTERIOR WALL SURFACES, 1 1/2" FOR BEAMS, GIRDERS AND COLUMNS. FOR ALL CONCRETE EXPOSED TO WEATHER OR EARTH, CLR COVER SHALL BE 1 1/2". FOR CONCRETE PLACED AGAINST EARTH, MINIMUM CLR COVER SHALL BE 3".
9. BAR REINFORCEMENT SHALL CONFORM TO ASTM A-615, GRADE 60 FOR BARS LESS THAN OR EQUAL TO (<=) #7. FOR BARS GREATER THAN OR EQUAL TO (>=) #8, STEEL SHALL BE ASTM A-615 GRADE 75.
10. WELDED WIRE FABRIC (WWF) SHALL CONFORM TO ASTM A185 (FOR PLAIN WIRE) AND ASTM A497 (FOR DEFORMED WIRE), Fy = 70 000PSI.
11. EPOXY COATED REINFORCEMENT SHALL BE USED WHERE NOTED IN THE CONTRACT DOCUMENTS.
12. PROVIDE DOWELS OR CONTINUOUS REINFORCING BETWEEN ALL CONCRETE ELEMENTS. FOR FOUNDATIONS PROVIDE DOWELS OF SAME NUMBER AND SIZE AS THE VERTICAL REINFORCEMENT OF STRUCTURE ABOVE UNLESS NOTED OTHERWISE. FOR OTHER STRUCTURAL ELEMENTS VERTICAL DOWELS SHALL MATCH THE GREATER REINFORCING OF EACH ELEMENT.
13. BAR SPLICES MAY BE DELETED AND CONTINUOUS REINFORCING USED AT CONTRACTOR'S OPTION. BAR SPLICES SHALL BE MADE AT POINTS OF MINIMUM STRESS. IN FRAMED BEAMS AND SLABS SPLICE TOP BARS AT MID-SPAN, BOTTOM BARS OVER SUPPORTS.
14. STEEL REINFORCEMENT SHOP DRAWINGS SHALL BE PREPARED BY THE CONTRACTOR IN ACCORDANCE WITH ACI-315: "DETAILS AND DETAILING OF CONCRETE REINFORCEMENT", AND SHALL INDICATE:
   - A. MATERIAL AND GRADE;
   - B. BAR SCHEDULES WITH BAR LENGTHS AND BENT BAR DIAGRAMS;
   - C. ARRANGEMENT, SPACING, COVER, LAP LOCATIONS AND LENGTHS;
   - D. SPLICE DETAILS FOR MECHANICAL SPLICES;
   - E. SUPPORTS FOR CONCRETE REINFORCEMENT;
   - F. SPECIAL REINFORCEMENT AT OPENINGS.
15. WHERE A 90-DEG, 135 -DEG OR 180-DEG HOOK IS GRAPHICALLY INDICATED, PROVIDE CORRESPONDING HOOKS PER ACI STANDARD U.O.N.
16. DOWELS SHALL MATCH SIZE AND SPACING OF MAIN REINFORCEMENT UON.
17. WHERE BARS OF DIFFERENT SIZES LAP, PROVIDE LAP SPLICE LENGTH FOR LARGER BAR UON.
18. REINFORCEMENT SHALL HAVE CONCRETE PROTECTION (CLEAR COVER) PER ACI 318 UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
19. UNLESS OTHERWISE NOTED ALL LAP SPLICES ARE TO BE TENSION LAP SPLICES PER LAP SPLICE AND EMBEDMENT SCHEDULE.
20. CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND LOCATIONS OF ALL OPENINGS, PIPE SLEEVES, FLOOR DEPRESSIONS, CURBS ETC., AS REQUIRED BY OTHER TRADES BEFORE CONCRETE IS PLACED.
21. SHEAR KEY, WHERE SHOWN, SHALL BE MINIMUM 2"X2", U.O.N.

CONCRETE JOINTS:

1. CONSTRUCTION JOINTS SHALL BE INSTALLED SUCH THAT STRENGTH AND APPEARANCE OF CONCRETE ARE NOT IMPAIRED, AT LOCATIONS INDICATED OR AS APPROVED BY THE ARCHITECT AND STRUCTURAL ENGINEER. SEE PROJECT SPECIFICATIONS FOR LIMITS ON LOCATION AND SPACING.
   - A. LOCATE JOINTS FOR BEAMS, SUSPENDED SLABS, JOISTS AND GIRDERS IN THE MIDDLE THIRD OF SPANS. OFFSET JOINTS IN GIRDERS A MINIMUM DISTANCE OF TWICE THE BEAM WIDTH FROM A BEAM-GIRDER INTERSECTION.
   - B. LOCATE HORIZONTAL JOINTS IN WALLS AND COLUMNS AT THE UNDERSIDE OF FLOORS, SLABS, BEAMS, AND GIRDERS AND AT THE TOP OF FOOTINGS OR FLOOR SLABS, OR AT 40-FEET MAXIMUM HEIGHT, UNLESS PERMITTED BY ENGINEER.
   - C. LOCATE VERTICAL JOINTS IN WALLS AT DISCONTINUITIES, BESIDES PIERS INTEGRAL WITH WALLS, NEAR REENTRANT CORNERS, AND IN CONCEALED LOCATIONS WHERE POSSIBLE. PREFERRED JOINT INTERVALS SHALL BE 15-25 FEET AS APPROPRIATE, WITH A MAXIMUM SPACING OF 40-FEET. AVOID LOCATING VERTICAL JOINTS WITHIN 15-FEET OF A BUILDING CORNER.
   - D. LAYOUT OF CONSTRUCTION JOINTS IN SLABS ON GRADE MAY CORRESPOND WITH CONTRACTION JOINTS.
   - E. LEAVE 7 DAYS, MINIMUM, BETWEEN ADJACENT POURS IN WALLS, UNLESS APPROVED BY ENGINEER.
2. WALL CONTRACTION JOINTS SHALL BE PROVIDED TO CONTROL THE CRACKING PATTERNS AT LOCATIONS INDICATED, OR AS APPROVED BY THE ARCHITECT.
   - A. LOCATE JOINTS AT COLUMN LINES WHERE APPLICABLE WITH SPACING NOT TO EXCEED TWICE THE WALL HEIGHT OR 24-FEET AND PREFERABLY MATCHES LAYOUT OF SLAB JOINTING
   - B. FORM CONTRACTION JOINTS FOR A DEPTH EQUAL TO AT LEAST ONE-FOURTH OF CONCRETE WALL THICKNESS BY ATTACHING ½"- WIDE BEVELLED WOOD STRIPS TO INSIDE OF BOTH SIDES OF CONCRETE FORM.

CONCRETE MASONRY

1. ALL CONCRETE MASONRY UNITS (CMU) SHALL BE NORMAL WEIGHT AGGREGATE CONFORMING TO THE REQUIREMENTS OF ASTM C-90 TYPE 1, PROVIDE TWO-CELL HOLLOW BLOCK WITH NOMINAL FACE SIZE 8"X16" WITH 8" OR 8" NOMINAL THICKNESS AT LOCATIONS AS SHOWN ON ARCHITECTURAL DRAWINGS. MINIMUM EXTERIOR WALL NOMINAL THICKNESS SHALL BE 8". ALL UNITS SHALL BE PLACED IN RUNNING BOND.
2. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE MASONRY SHALL BE F'M=2000PSI, DETERMINED BY THE UNIT STRENGTH METHOD.
3. MORTAR SHALL CONFORM TO ASTM C270 TYPE M OR S, MINIMUM COMPRESSIVE STRENGTH = 2000 PSI.
4. GROUT SHALL CONFORM TO ASTM C476, MINIMUM COMPRESSIVE STRENGTH 2000 PSI.
5. CMU REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO ASTM A615, GRADE 60, MIN fy=60 KSI.
6. BOND BEAMS AND ALL CELLS WITH VERTICAL REINFORCEMENT SHALL BE FULLY GROUTED.
7. HORIZONTAL JOINT REINFORCEMENT SHALL BE WELDED "LADDER" OR "TRUSS" DESIGN, CONFORMING TO ASTM A951, WITH WIRE CONFORMING TO ASTM A82, FOR REINFORCEMENT. AT EXTERIOR WALLS, HOT-DIP GALVANIZE TO ASTM A153 (1.5OZ/FT2). FOR INTERIOR WALLS, MILL GALVANIZE TO ASTM A641 (0.1OZ/FT2)
8. VERTICAL REINFORCEMENT SHALL BE CONTINUOUS BETWEEN SUPPORTS WITH MINIMUM SPLICE LENGTHS OF 24". PROVIDE ADDITIONAL BARS EACH CORNER, END OF WALL, EDGE OF OPENING, AND EDGE WHERE WALL IS INTERRUPTED BY STEEL COLUMN.
9. PROVIDE THE FOLLOWING MINIMUM REINFORCEMENT

WALL TYPE	VERTICAL REINFORCEMENT	HORIZONTAL JOINT REINFORCEMENT
8" EXTERIOR WALLS	#5 @ 24"	3/16" @ @ 16" O.C.
6" INTERIOR PARTITION WALLS	#5 @ 48" OC	3/16" @ @ 48" O.C.
8" INTERIOR PARTITION WALLS	#4 @ 48" OC	3/16" @ @ 16" O.C.

10. THE FIRST BLOCK COURSE OF ALL MASONRY WALLS SHALL BE FILLED SOLID WITH GROUT.
11. CONCRETE BLOCK BELOW BEAM BEARING POINTS SHALL BE FILLED SOLID WITH GROUT FOR A MINIMUM OF TWO COURSES IN DEPTH AND FOR A WIDTH OF 24".
12. ALL MASONRY WALLS SHALL BE ADEQUATELY BRACED DURING CONSTRUCTION. FLOOR AND ROOF DIAPHRAGMS PROVIDE STABILITY FOR WALLS. UNTIL THESE ARE IN PLACE, MASONRY WALLS SHALL NOT BE BUILT HIGHER THAN 10 TIMES THEIR THICKNESS WITHOUT BRACING.
13. LINTELS SHALL BE INSTALLED OVER ALL OPENINGS IN MASONRY WALLS AS FOLLOWS:

    FOR MASONRY OPENINGS 4'-0" OR LESS USE
    (1) STEEL L 4" X 3 1/2" X 5/16" FOR EACH 4" OF WALL THICKNESS
    OR
    (1) 8" DEEP PRECAST CONCRETE LINTEL WITH (1) #3 BAR TOP AND BOTTOM FOR EACH 4" OF WALL THICKNESS.

    FOR MASONRY OPENINGS 4'-1" TO 7'-0" USE.
    (1) STEEL L 5" X 3 1/2" X 5/16" FOR EACH 4" OF WALL THICKNESS
    OR
    (1) 8" DEEP PRECAST CONCRETE LINTEL WITH (1) #5 BAR TOP AND BOTTOM FOR EACH 4" OF WALL THICKNESS.

    A. FOR STEEL L LINTELS, 2 1/2" LEGS ARE HORIZONTAL.
    B. PROVIDE MINIMUM 8" BEARING EACH END FOR STEEL LINTELS.
    C. PROVIDE MINIMUM 8" BEARING EACH END FOR PRECAST LINTELS.
    D. PRECAST CONCRETE LINTELS TO HAVE FC=3000 PSI (MIN).

STRUCTURAL STEEL:

1. FABRICATION, CONNECTION DESIGN AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, "MANUAL OF STEEL CONSTRUCTION, LOAD AND RESISTANCE FACTORED DESIGN" LATEST EDITION.
2. UNLESS OTHERWISE NOTED, ALL STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING:
   - A. WIDE-FLANGE SECTIONS: ASTM A992 GRADE 50 (FY = 50 KSI)
   - B. ANGLES AND CHANNELS: ASTM A36 (FY = 36 KSI)
   - C. PLATES, BARS AND MEMBERS BUILT-UP FROM PLATES: ASTM A572 (FY = 50 KSI)
   - D. ROUND HSS: ASTM A500 GRADE B (FY= 42 KSI)
   - E. RECTANGULAR HSS: ASTM A500 GRADE B (FY=46 KSI)
   - F. WT SECTIONS: ASTM A992 GRADE 50 (FY = 50 KSI)
   - G. PIPE: ASTM F1554 GRADE 36 (FU=58 KSI)
   - H. STEEL PINS (FOR ROUND COLUMNS): AISI 1144 (OR APPROVED EQUAL)
3. THE CONTRACTOR SHALL SUBMIT A STEEL ERECTION PROCEDURE, PREPARED UNDER THE SUPERVISION OF A STRUCTURAL ENGINEER LICENSED IN THE STATE OF THE LOCATION OF THE PROJECT (THE CONTRACTOR'S ENGINEER) FOR REVIEW BY THE STRUCTURAL ENGINEER OF RECORD. THIS PROCEDURE MUST INCLUDE THE PROPOSED SURVEY REQUIRED BY THE STEEL SPECIFICATIONS.
4. STEEL USING COMPLETE JOINT PENETRATION GROOVE WELDS SHALL HAVE A MINIMUM CHARPY V-NOTCH IMPACT TESTING VALUE AS FOLLOWS:
   - A. ASTM A6/A6M NOT-ROLLED SHAPES WITH A FLANGE THICKNESS EXCEEDING (2) INCHES AND BUILT-UP HEAVY SHAPES WITH PLATES EXCEEDING (2)INCHES IN THICKNESS: 20 FT-LB @ 70 DEG. F
   - B. REGARDLESS OF THICKNESS, ALL TRUSSES, LATERAL SYSTEM MEMBERS (INCLUDING COLUMNS, WIND GIRDERS, BRACES, ETC.): 20 FT-LB @ 70 DEG. F
   - C. STEEL EXPOSED TO TEMPERATURES IN SERVICE BELOW 50 DEG.F: 25 FT-LB @ 40 DEG.F.
   - D. WELD METAL: 20 FT-LB @ MINUS 20 DEG. F AND 40 FT-LB @ 70 DEG. F
   - E. WELD METAL EXPOSED TO TEMPERATURES IN SERVICE BELOW 50 DEG. F: 25 FT-LB @ MINUS 40 DEG. F
   - F. TESTING IS TO BE IN ACCORDANCE WITH ASTM A6/A6M, SUPPLEMENTARY REQUIREMENT S30, CHARPY V-NOTCH IMPACT TEST FOR STRUCTURAL SHAPES – ALTERNATE CORE LOCATION, AT ROLLED SHAPES AND ASTM A673 FOR PLATES, AT ANY PERMITTED LOCATIONS.
5. TOP OF STEEL ELEVATION SHALL BE AT BOTTOM OF DECK UNLESS OTHERWISE NOTED.
6. WHERE A MEMBER IS INDICATED AS BENT, FACETTED OR CRANKED, ENSURE FULL MEMBER CAPACITY IS PROVIDED THROUGH JOINT. MEMBER SPLICES SHALL ALSO HAVE FULL MEMBER CAPACITY UNLESS OTHERWISE NOTED.
7. FIELD CUTTING OR DRILLING STRUCTURAL STEEL IS STRICTLY PROHIBITED WITH PRIOR REVIEW AND APPROVAL BY DESIGN ENGINEER. ALL HOLES AND CUTS SHALL BE PERFORMED IN THE SHOP AS IDENTIFIED ON STRUCTURAL DRAWINGS OR SHOP DRAWINGS.
8. ALL STEELS EXPOSED TO WEATHER ARE TO BE PAINTED WITH RUST INHIBITIVE PAINT, MINIMUM TWO PRIME COAT AND ONE FINISH COAT.
9. BOLTED CONNECTIONS:
   - A. ALL BOLTS SHALL CONFORM TO ASTM A325 OR A490, NUTS SHALL CONFORM TO ASTM A563 AND WASHER SHALL CONFORM TO ASTM F436
   - B. MINIMUM BOLT SIZE FOR THIS PROJECT ARE TO BE 7/8" DIA A325 AND 1 1/8"DIA A490 BOLTS. MINIMUM BOLTED CONNECTIONS SHALL BE MADE WITH TWO A325N BOLTS, 7/8"DIAMETER. ALTERNATELY A490N MAY BE SUBSTITUTED.
   - C. ANCHOR RODS SHALL CONFORM TO ASTM-1554 GRADE 55 WITH WELDABILITY SUPPLEMENT S1, UNO. SUBMIT GRADE CERTIFICATIONS FOR RECORD. STEEL SUPPLIER SHALL PROVIDE RIGID STEEL TEMPLATES FOR ANCHOR ROD INSTALLATION.
   - D. SLIP-CRITICAL CONNECTIONS: SLIP-CRITICAL BOLTS SHALL BE FULLY TENSIONED WITH FAYING SURFACE PREPARATION CLASS B. SLIP-CRITICAL CONNECTIONS SHALL BE USED IN THE FOLLOWING LOCATIONS:
     1. BOLTS INDICATED IN THE DRAWINGS AS SLIP, CRITICAL (SC),
     2. BOLTS LOADED IN DIRECT TENSION,
     3. AT BOLTED COLUMN SPLICES,
     4. AT CONNECTIONS OF BEAMS AND GIRDERS TO COLUMNS, WHERE OVERSIZED HOLES HAVE BEEN SPECIFIED FOR INSTALLATION,
     5. AT CONNECTIONS OF BEAMS AND GIRDERS TO BRACED FRAMES, WHERE THE BEAM/GIRDER ALIGNS WITHIN 12" OF BRACING WORKPOINT,
     6. AT CONNECTIONS DESIGNATED AS HAVING A HORIZONTAL DESIGN LOAD,
     7. AT BRACING CONNECTIONS WHERE HOLE SIZES ARE MORE THAN 1/16" LARGER THAN THE BOLT DIAMETER,
     8. AT FLANGES OF BOLTED MOMENT CONNECTIONS,
     9. AT SLOTTED HOLES NOT SPECIFICALLY NOTED AS "SNUG TIGHT".
   - E. TENSION CONTROL ASSEMBLIES SHALL CONFORM TO ASTM F1852 FOR A325 TENSION CONTROL ASSEMBLIES AND ASTM F2280 FOR A490 TENSION CONTROL ASSEMBLIES.
   - F. PRE-TENSIONED BOLTED CONNECTIONS: PRE-TENSIONED BOLTED CONNECTIONS SHALL BE FULLY TENSIONED AND USED IN THE FOLLOWING LOCATIONS:
     1. WHEREVER EQUIRED IN THE AISC PROVISIONS
     2. WHEREVER NOTED ON THE DRAWINGS
     3. AT ALL CONNECTIONS FOR MEMBERS DIRECTLY OR INDIRECTLY SUPPORTING COLUMNS, POSTS, STRUTS, BRACES, MECHANICAL EQUIPMENT AND STAIRS.
     4. FOR ALL BOLTS WITH TENSION L

AD1	BeveLED (downlight 3021) - Or Approved Equal	3231A30 * S * LRTA4 8424-C2-30KS-30-NC * DIML2 - Or Approved Equal	recessed downlight	LED	-	1625	24	white	3000	dim	120/277
AD2	BeveLED (downlight 3021) - Or Approved Equal	3231A30 * S-LRTA4 8433 C2 30KS 30-NC * DIML2 - Or Approved Equal	recessed downlight	LED	-	1950	33	white	3000	dim	120/277
AD3	BeveLED (downlight 3021) - Or Approved Equal	3021-AC1-F-*-LRTD4-9024-C2-30KS-50-NC-* - Or Approved Equal	recessed downlight	LED	-	1690	24	white	3000	switch	120/277
AD4	BeveLED (downlight 3021) - Or Approved Equal	3021W-AC1-F * LRTD4-9016-C2-30KS-30-NC * - Or Aporoved Equal	recessed downlight	LED	-	1200	16	white	3000	switch	120/277
AD5*	New Star - Or Approved Equal	INSP-8-1-L35-FP-UN-WH-X - Or Approved Equal	bulkhead	LED	1	2000	20	white	3500	switch	120/277
AD6	Delray Lighting (7601 1 32) - Or Approved Equal	7601 1 32 ** with custom diffuse lens - Or Approved Equal	downlight	CFL	1	2940	32	black	3500	switch	277
AD7	Delray Lighting - Or Approved Equal	7601 2 32 ** with custom diffuse lens - Or Approved Equal	downlight	CFL	2	5272	32	black	3500	switch	277
AD8	BeveLED (downlight 3231) - Or Approved Equal	3231A30W * S * LRTA4-8424-C2-30KS-30-NC *-DIML2 - Or Approved Equal	recessed downlight	LED	-	1625	24	white	3000	dim	120/277
AF1	B-K Lighting (Yosemite Series) - Or Approved Equal	YO FL 35/70 ** 10 11 CV ** - Or Approved Equal	accent	CMH	1	-	70	black	3000	switch	277
AF2	B-K Lighting (Yosemite Series) - Or Approved Equal	YO FL 35/70 ** 10 11 CV ** - Or Approved Equal	accent	CMH	1	-	35	black	3000	switch	277
AF3	Ovalinear (style 159) - Or Approved Equal	M159 035G S 99 * V0 + AE0V2000 - Or Approved Equal	uplight	CDM	1	-	35	black	3000	switch	TBD
AF4	Musco Lighting - Or Approved Equal	Light Structure Green - Or Approved Equal		MH	1	-	1500	black		switch	277
AF5	B-K Lighting - Or Approved Equal	YO WW-FL/FISTOM-13 11 CS - Or Approved Equal	accent downlight	CMH	1	-	70	black	4000	switch	277
AF6											
AF7	Bega - Or Approved Equal	77056LED83 + D60 + 757 + S51 - Or Approved Equal	compact floodlight	LED		1723	30	black	3000	switch	TBD
AG1	Bega - Or Approved Equal	611-4453 ETC 140[A] ASC INGROUND UPLIGHTS FLUSH - Or Approved Equal	accessory								
AF8	Ovalinear (style 159) - Or Approved Equal	M159 035G X 99 * V0 + AEV-*-*-0 + AE4V2000 - Or Approved Equal	uplight	CDM	2	-	35	black	3000	switch	TBD
AF9	Ovalinear (style 159) - Or Approved Equal	M159 035G X 99 * V0 + AEV-*-*-0 + AE4V2000 - Or Approved Equal	uplight	CDM	1	-	35	black	3000	switch	TBD
AG1	we-ef (611-4453 ETC140 flush vs. anti-slip coating) -Or Approved Equal	611-4453 ETC 140[A] ASC INGROUND UPLIGHTS FLUSH - Or Approved Equal	inground uplight	CMH	1	5600	70	black	3000	switch	TBD
AG2	we-ef (611-3072ETC130 flush version) - Or Approved Equal	611-3072 ETC130 GB INGROUND UPLIGHTS FLUSH - Or Approved Equal	inground uplight	CMH	1	3000	39	black	3000	switch	TBD
AG3	we-ef (638-3031 CTY150) - Or Approved Equal	638-3031 CTY 150 - Or Approved Equal	path light	CFM	1	3200	42	black	3000	switch	TBD
AL1*	Zumtobel Stotlight - Or Approved Equal	SLDI-4-IT-I-N-S-830-KK-P-X-W-U-T-X - Or Approved Equal	TBAR CEILING	LED	-	4400	40	white	3000	switch	277
AL2	Ledalite (Sync) - Or Approved Equal	7406 T02 0 N * * 2 * W - Or Approved Equal	pendant	TS	2	-	32	white	3000	switch	277
AL3	Prudential Lighting (Snap) - Or Approved Equal	S1 178 * YGW* 277 SUR * * - Or Approved Equal	downlight	FL	1	-	17, 32	white	3000	switch	277
AL4	Litecontrol (Mod) - Or Approved Equal	R-D-44-1-*-T8-PBSS-CWM-*-*-*-*-277 - Or Approved Equal	downlight	FL	1	-	32	white	3000	switch	277
AL5	Prudential Lighting (Snap) - Or Approved Equal	S1 178 * YGW* 277 SUR * * - Or Approved Equal	downlight	FL	1	-	17	white	3000	switch	277
AL6	Prudential Lighting (Snap) - Or Approved Equal	S1 178 * YGW* 277 SUR * * - Or Approved Equal	downlight	FL	1	-	17	white	3000	switch	277
AL7	Bruck - Orion Bolt - Or Approved Equal	135401-1	tape	LED	-	-	1.25	white	3000	switch	24
AL8	HE Williams (92) - Or Approved Equal	92-4-2-32-A-UNV - Or Approved Equal	downlight	FL	2	-	32		3000	switch	120/277
AL9*	Bega - Or Approved Equal	88602 - Or Approved Equal	ingrade linear (drive over)	FL	-	2000	28		3000	switch	
AM1	BeveLED (3231) - Or Approved Equal	3231A30 * S-* LRTA4-8433-C2-30KS-30-NC-*-DIML2 - Or Approved Equal	downlight	LED	-	1625	24	white	3000	dim	120/277
AP1	Kim Lighting (SAR - The Archetype) - Or Approved Equal	1SA-SAR2-1SDMHX-X-A-3X-HS-TL + LTRA16-6188-SA-BL - Or Approved Equal	parking pole	LED	-	-	150	black	4000	switch	277
AP2	Kim Lighting (SAR - The Archetype) - Or Approved Equal	1SA-SAR3-1SDMHX-X-A-3X-HS-TL + LTRA16-6188-SA-BL - Or Approved Equal	parking pole	LED	-	-	150	black	4000	switch	277
AP3	Kim Lighting - Or Approved Equal	6SA-SAR4-1SDMHX-X-A-3X-HS-TL with LTRA 16' Series Pole - Or Approved Equal	parking pole	LED	-	-	150	black	4000	switch	277
AR1	Kurtzon Lighting - Or Approved Equal	FP-F-3-2X2-AF1718-UNV-WHT-A19 - Or Approved Equal	downlight	FL	4		17		3500	switch	UNV
AW1*	Bega - Or Approved Equal	22225 - Or Approved Equal	recessed wall	CFL	1	1200	18	black	3001	switch	277
AW2*	Bega - Or Approved Equal	22044 - Or Approved Equal	recessed wall	CFL	1	1200	18	black	3000	switch	277
AW3	LED Linear (XOO Light Hercules IP67) - Or Approved Equal	XOOLIGHT HERCULES W82/24"-*-T-IP68 - Or Approved Equal	linear	LED	-	1,048/m	10.7		3200	switch	TBD
AW5	Lumascape usa (LS33SAN5 - ZLED) - Or Approved Equal	LS33SAN5-ZLED 6M6-MR-13 - Or Approved Equal	pool light	LED	-		6		3000	switch	TBD

Notes:

1. Fixture with references marked with an asterix (*) have been updated as previous products specified have been discontinued.
2. Contractor to measure linear runs of all fixtures from architectural drawings to ensure correct run lengths are identified before procurement.
3. All fixture finishes to be confirmed by the architect.
4. All fixtures denoted with "EM" shall be provided the emergency battery packs.
5. Refer to architects drawings for all fixture locations and mounting heights.
6. Fixture type AL8 to be provided in 2 x 4ft lengths mounted end to end

NO.	DATE	ISSUED FOR	BY
2	02/16/18	ADDENDUM # 9	ARUP
1	11/15/17	BID SET	ARUP

SEAL AND SIGNATURE

CONSULTANTS

ARCHITECT
GRIMSHAW
637 West 27th Street
New York NY10001
T +1 646 293 3600
F +1 646 293 3610

Environmental Protection

NYC Parks

PROJECT
PUBLIC BUILDINGS DIVISION
Croton Water Treatment Plant
Above Grade Facilities - Package 4 - Phase B
3651 Jerome Avenue Bronx, NY 10467
Capital Project #: HED-CLUB

CLIENT
NEW YORK CITY DEPARTMENT OF DESIGN + CONSTRUCTION

STATUS: ADDENDUM #8

DRAWING TITLE: LIGHTING SCHEDULE

DATE: 02/15/18
SCALE: N/A
DRAWN: ARUP
CHECKED: ARUP
AUTHORIZED: ARUP
SHEET: C R O B _ E _ 8 0 0

FMS ID: **CRO-AGS**

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS
30-30 THOMSON AVENUE LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000 WEBSITE www.nyc.gov/buildnyc

Department of Design and Construction

Contract for Furnishing all Labor and Material Necessary and Required for:

CONTRACT NO. 1 **GENERAL CONSTRUCTION WORK**

Croton New Above Ground Structure and Landscaping Rebid

LOCATION: **3651 Jerome Avenue**
BOROUGH: **Bronx, NY 10467**
CITY OF NEW YORK

Contractor

Dated _____ , 20 _____

Entered in the Comptroller's Office

First Assistant Bookkeeper

Dated _____ , 20 _____

Department of Design and Construction

PROJECT ID: CRO-AGS

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

30-30 THOMSON AVENUE
LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000
WEBSITE www.nyc.gov/buildnyc

VOLUME 2 OF 3

PROJECT LABOR AGREEMENT
INFORMATION FOR BIDDERS
CONTRACT
PERFORMANCE AND PAYMENT BONDS
SCHEDULE OF PREVAILING WAGES
GENERAL CONDITIONS

FOR FURNISHING ALL LABOR AND MATERIALS
NECESSARY AND REQUIRED FOR THE PROJECT

Croton New Above Ground Structure and Landscaping Rebid

LOCATION: 3651 Jerome Avenue
BOROUGH: Bronx, NY 10467
CITY OF NEW YORK

CONTRACT NO. 1 GENERAL CONSTRUCTION WORK

NYC Department of Environmental Protection

Grimshaw Architects

Date: October 26, 2017

8-028

Department of Design and Construction

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

30-30 THOMSON AVENUE
LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000
WEBSITE www.nyc.gov/buildnyc

VOLUME 2 OF 3

PROJECT LABOR AGREEMENT
INFORMATION FOR BIDDERS
CONTRACT
PERFORMANCE AND PAYMENT BONDS
SCHEDULE OF PREVAILING WAGES
GENERAL CONDITIONS

FOR FURNISHING ALL LABOR AND MATERIALS
NECESSARY AND REQUIRED FOR THE PROJECT

2015 "New Construction" Project Labor Agreement

NOTICE: THIS CONTRACT IS SUBJECT TO A NEW PROJECT LABOR AGREEMENT EXECUTED IN 2015

This contract is subject to the attached Project Labor Agreement ("PLA") entered into between the City and the Building and Construction Trades Council of Greater New York ("BCTC") affiliated Local Unions. By submitting a bid, the Contractor agrees that if awarded the Contract the PLA is binding on the Contractor and all subcontractors of all tiers. The bidder to be awarded the contract will be required to execute the attached Letter of Assent prior to award. Contractor shall include in any subcontract a requirement that the subcontractor, and sub-subcontractors of all tiers, become signatory to and bound to the PLA with respect to the subcontracted work. Contractor will also be required to have all subcontractors of all tiers execute the attached Letter of Assent prior to such subcontractors performing any work on the Project. Bidders are advised that the City of New York and City agencies have entered into multiple PLAs. The terms of individual PLAs, while similar, are not identical. All bidders should carefully read the entire PLA that governs this Contract.

In addition, please note that there are significant differences between the 2015 PLA attached to this bid and the Citywide Renovation PLA as well as previous new construction PLAs. The Contractor is urged to review the entire PLA. Significant changes include:

- **Grievances: The grievance procedure governing disputes under the PLA has been clarified. See PLA Article 9, Section 1.**

- **Delinquent Contractors: Contractors and Subcontractors who do not make required payments to union funds on a timely basis are subject to requirements to submit cancelled checks or another form of proof of payment in addition to certified payroll reports when requesting payment. See PLA Article 11, Section 2.**

- **Payment to Union Funds for Non-Union Workers: Non-union Contractors with bona fide private benefit plans that satisfy the requirements of Labor Law 220 will not be required to pay into union benefit funds for "core" non-union employees (working pursuant to Article 4, Section 2 of the PLA) who are already covered under such bona fide private benefit plans. See PLA Article 11, Section 2.**

- **Veterans Day: Veterans Day has been added to the list of standard holidays. See Article 12, Section 4.**

- **Reporting Pay for Weather Events: The usual reporting pay requirement of two hours for employees who report to their work location pursuant to their regular schedule does not apply when the National Weather Service issues a Weather Advisory and the Contractor speaks to the employee at least four hours before his/her shift starting time. See Article 12, Section 6.**

To the extent that the terms of the PLA conflict with any other terms of the invitation for bids, including the Standard Construction Contract, the terms of the PLA shall govern. Where, however, the invitation for bids, including the Standard Construction Contract, requires the approval of the City/Department, the PLA does not supersede or eliminate that requirement.

In addition to the various provisions regarding work rules, Contractors should take special note of the requirement that Contractors and Subcontractors make payments to designated employee benefit funds. See PLA Article 11, Section 2. The PLA also contains provisions for what occurs when a Contractor or a subcontractor fails to make required payments into the benefit funds, including potentially the direct payment by the City to the benefit fund of monies owed and corresponding withholding of payments to the Contractor. See PLA Article 11, Section 2. The City strongly advises Contractors to read these provisions carefully and to include appropriate provisions in subcontracts addressing these possibilities.

This Contract is subject to the apprenticeship requirements of Labor Law §222 and to apprenticeship requirements established by the Department pursuant to Labor Law §816-b. Please be advised that the involved trades have apprenticeship programs that meet the statutory requirements of Labor Law 222(e) and the requirements set by the Department pursuant to Labor Law §816-b, Contractors and subcontractors who agree to perform the Work pursuant to the PLA are participating in such apprenticeship programs within the meaning of Labor Law §222(e) and the Department's directive.

If this Contract is subject to the Minority-Owned and Women-Owned Business Enterprise ("M/WBE") program implemented pursuant to New York City Administrative Code §6-129, the specific requirements of M/WBE participation for this Contract are set forth in Schedule B entitled the "Subcontractor Utilization Plan," and are detailed in a separate Notice to Prospective Contractors included with this bid package. If such requirements are included with this Contract, the City strongly advises Contractors to read those provisions, as well as PLA Article 4, Section 2(C), carefully. A list of certified M/WBE firms may be obtained from the Department of Small Business Services (DSBS) website at www.nyc.gov/getcertified, by emailing DSBS at MWBE@sbs.nyc.gov, by calling the DSBS certification hotline at (212) 513-6311, or by visiting or writing DSBS at 110 William St., 7th floor, New York, New York, 10038.

The local collective bargaining agreements (CBAs) that are incorporated into the PLA as PLA Schedule A Agreements are available on computer disk from the Department's Contract Officer upon the request of any prospective bidder. Please note that the "PLA Schedule A" is distinct from the Department's Schedule A that is a part of this invitation for bids.

A contact list for the participating unions is set forth after the FAQs.

Below are answers to frequently asked questions (FAQs) about this PLA:

1. **Q.** Does a Contractor need to be signatory with the unions in the NYC Building and Construction Trades Council in order to bid on projects under the PLA?

A. No, any contractor may bid by signing and agreeing to the terms of the PLA. The contractor need not be signatory with these unions by any other labor agreement or for any other project.

2. **Q.** Does a Contractor agreeing to the PLA and signing the Letter of Assent create a labor agreement with these unions outside of the project covered by the PLA?
   A. No, the PLA applies only to those projects that the Contractor agrees to perform under the PLA and makes no labor agreement beyond those projects.

3. **Q.** Do the provisions of the PLA apply equally to subcontractors as well as contractors and how does the PLA affect the subcontractors that a bidder may utilize on the project?
   A. Yes, the PLA applies to subcontractors and all subcontractors must agree to become party to the PLA. See PLA Art. 2, Sec. 8. Subject to the Department's approval of subcontractors pursuant to Article 17 of the Standard Construction Contract, a Contractor may use any subcontractor, union or non-union, as long as the subcontractor signs and agrees to the terms of the PLA.

4. **Q.** Are bidders required to submit Letters of Assent signed by proposed subcontractors with their bid in order to be found responsive?
   A. No, bidders do not have to submit signed Letters of Assent from their subcontractors with their bid. Subcontractors, however, will be required to sign the Letter of Assent prior to being approved by the Department.

5. **Q.** May a Contractor or subcontractor use any of its existing employees to perform this work?
   A. Generally labor will be referred to the Contractor from the respective signatory local unions. See PLA Article 4. However, Contractors and subcontractors may continue to use up to 12% of their existing, qualifying labor force for this work, in accordance with the terms of PLA Article 4, Section 2B.

6. **Q.** Must the City set M/WBE participation goals for the particular project or contract in order for a certified M/WBE to utilize the provisions of PLA Article 4, Section 2C?
   A. No. PLA Article 4, Section 2(C) specifies what categories of M/WBEs are eligible to take advantage of this provision (i.e., those M/WBEs for which the City is authorized to set participation goals under §6-129). For purposes of section 2(C), it is not necessary for the project to be subject to §6-129 or for the City to have actually set participation goals for the particular contract or project. The result is the same where a project receives State funding and therefore is subject to the requirements of Article 15-A of the Executive Law.

7. **Q.** May a Contractor bring in union members from locals that are not signatory unions?
   A. Referrals will be from the respective signatory locals and/or locals listed in Schedule A of the PLA. Contractors may utilize 'traveler provisions' contained in the

local collective bargaining agreements (local CBAs) where such provisions exist and/or in accordance with the provisions of PLA Article 4, Section 2.

8. **Q.** Does a non-union employee working under the PLA automatically become a union member?
A. No, the non-union employee does not automatically become a union member by working on a project covered by the PLA. Non-union employees working under the PLA are subject to the union security provisions (i.e., union dues/agency shop fees) of the local CBAs while on the project. These employees will be enrolled in the appropriate benefit plans and earn credit toward various union benefit programs except in certain circumstances as set forth in the PLA. See PLA Article 4, Section 6 and Article 11.

9. **Q.** When will the agency shop dues payer affiliate workers become eligible for union benefits?
A. Union benefit plans have their own plan documents that determine eligibility and workers will become eligible for certain benefits at different points in time. Contractors who will have agency shop dues payer affiliate workers should speak with the respective union(s) as to benefit eligibility thresholds.

10. **Q.** Are all Contractors and subcontractors working under the PLA, including non-union Contractors and Contractors signatory to collective bargaining agreements with locals other than those that are signatories to the PLA, required to make contributions to designated employee benefit funds?
A. Except in certain circumstances, as described in the following paragraph, Contractors and subcontractors working under the PLA will be required to contribute on behalf of all employees covered by the PLA to established jointly trusteed employee benefit funds designated in the Schedule A CBAs and required to be paid on public works under any applicable prevailing wage law. See PLA Article 11, Section 2. The Agency may withhold from amounts due to the Contractor any amounts required to be paid, but not actually paid into any such fund by the Contractor or a subcontractor. See PLA Article 11, Section 2 D.

Non-union Contractors with bona fide private benefit plans that satisfy the requirements of Labor Law 220 will not be required to pay into union benefit funds for their employees working pursuant to Article 4, Section 2 (B) and (C) ("core" employees) who are already covered under their bona fide private benefit plans. Supplemental benefit funds in excess of the annualized value of the private benefit plans will be paid to workers as additional wages in compliance with Labor Law 220. At the time of contract award, the Contractor shall make available to the contracting Agency a complete set of plan documents for each private benefit plan into which contributions will be made and/or coverage provided. The Contractor shall also provide certification from a certified public accountant as to the annualized hourly value of such benefits consistent with the requirements of Section 220. See PLA Article 11, Section 2.

11. **Q.** What happens if a Contractor or subcontractor fails to make a required payment to a designated employee benefit fund?

A. The PLA sets forth a process for unions to address a contractor or a subcontractor's failure to make required payments. The process includes potentially the direct payment by the City to the benefit fund of monies owed and the corresponding withholding of payments to the Contractor. See PLA Article 11, Section 2.

Upon notification by a union or fringe benefit fund that a Contractor is delinquent in its payment of benefits and a determination by the Agency that the union or fund has submitted appropriate documentation of such delinquency, the Agency will thereafter require the Contractor to submit cancelled checks or other equivalent proof of payment of benefit contributions with certified payroll reports for work covered by this PLA on which the Contractor is engaged.

The City strongly advises Contractors to read these provisions carefully and to include appropriate provisions in subcontracts addressing these possibilities.

12. **Q.** Does signing on to the PLA satisfy the Apprenticeship Requirements established for this bid?
A. Yes. By agreeing to perform the Work subject to the PLA, the bidder demonstrates compliance with the apprenticeship requirements imposed by this Invitation for Bids.

13. **Q.** Who decides on the number of workers needed?
A. Except as expressly limited by a specific provision of the PLA, a Contractor retains full and exclusive authority for the management of their operations, including the determination as to the number of employees to be hired and the qualifications thereof and the promotion, transfer, and layoff of its employees. See PLA Article 6, Section 1.

14. **Q.** May a contractor discharge a union referral for lack of productivity?
A. Again, except as expressly limited by a specific provision of the PLA, a Contractor retains full and exclusive authority for the management of their operations, including the right to discipline or discharge, for just cause, its employees. See PLA Article 6, Section 1.

15. **Q.** May a contractor assign a management person to site?
A. Yes. Managers are not subject to the provisions of the PLA, so there is no restriction on management and/or other non-trade personnel, as long as such personnel do not perform trade functions. See Article 3, Section 1.

16. **Q.** Does the PLA provide a standard work day across all the signatory trades?
A. Yes, all signatory trades will work an eight (8) hour day, Monday through Friday with a day shift at straight time as the standard work week.

17. **Q.** Does the PLA create a common holiday schedule for all the signatory trades?
A. Yes, the PLA recognizes nine (9) common holidays, including Veterans Day. See PLA Article 12, Section 4.

18. **Q.** May the Contractor schedule overtime work, including work on a weekend?
A. Yes, the PLA permits the Contractor to schedule overtime work, including work on weekends. See PLA Article 12, Sections 2, 3, and 5. To the extent that the Agency's approval is required before a Contractor may schedule or be paid for overtime, that approval is still required notwithstanding the PLA language.

19. **Q.** Are overtime payments affected by the PLA?
A. Yes, all overtime pay incurred Monday through Saturday will be at time and one half (1 ½). There will be no stacking or pyramiding of overtime pay under any circumstances. See PLA Article 12, Section 2. Sunday and holiday overtime will be paid according to each trade's CBA.

20. **Q.** Are there special provisions for Saturday work when a day is 'lost' during the week due to weather, power failure or other emergency?
A. Yes, when this occurs the Contractor may schedule Saturday work at weekday rates. See PLA Article 12, Section 5.

21. **Q.** Does the PLA contain special provisions for the manning of Temporary Services?
A. Yes. Where temporary services are required by specific request of the Agency or construction manager, they shall be provided by the Contractor's existing employees during working hours in which a shift is scheduled for employees of the Contractor. The need for temporary services during non-working hours will be determined by the Agency or construction manager. There will be no stacking of trades on temporary services. See PLA Article 15.

22. **Q.** What do the workers get paid when work is terminated early in a day due to inclement weather or otherwise cut short of 8 hours?
A. The PLA provides that employees who report to work pursuant to regular schedule and not given work will be paid two hours of straight time. Work terminated early for severe weather or emergency conditions will be paid only for time actually worked. In other instances where work is terminated early, the worker will be paid for a full day. See PLA Article 12, Sections 6 and 8. The usual reporting pay requirement of two hours for employees who report to their work location pursuant to their regular schedule does not apply when the National Weather Service issues a Weather Advisory and the Contractor speaks to the employee at least four hours before their shift starting time. See PLA Article 12, Section 6.

23. **Q.** If a local collective bargaining agreement of a signatory union expires during the project will a work stoppage occur on a project subject to the PLA?
A. No. All the signatory unions are bound by the 'no strike' agreement as to the PLA work. Work will continue under the PLA and the otherwise expired local CBA(s) until the new local CBA(s) are negotiated and in effect. See PLA Articles 7 and 19.

24. **Q.** May a Contractor working under the PLA be subject to a strike or other boycott activity by a signatory union at another site while the Contractor is a signatory to the PLA?

A. Yes. The PLA applies ONLY to work under the PLA and does not regulate labor relations at other sites even if those sites are in close proximity to PLA work.

25. **Q.** If a Contractor has worked under other PLAs in the New York City area, are the provisions in this PLA generally the same as the others?

A. While Project Labor Agreements often look similar to each other, and particular clauses are often used in multiple agreements, each PLA is a unique document and should be examined accordingly.

26. **Q.** What happens if a dispute occurs between the Contractor and an employee during the project?

A. The PLA contains a grievance and arbitration process to resolve disputes between the Contractor and the employees. See PLA Article 9.

27. **Q.** What happens if there is a dispute between locals as to which local gets to provide employees for a particular project or a particular aspect of a project?

A. The PLA provides for jurisdictional disputes to be resolved in accordance with the NY Plan. See PLA Article 10. A copy of the NY Plan is available upon request from the Department. The PLA provides that work is not to be disrupted or interrupted pending the resolution of any jurisdictional dispute. The work proceeds as assigned by the Contractor until the dispute is resolved. See PLA Article 10, Section 3.

Department. The PLA provides that work is not to be disrupted or interrupted pending the resolution of any jurisdictional dispute. The work proceeds as assigned by the Contractor until the dispute is resolved. See PLA Article 10, Section 3.

29. **Q.** Does the 2015 Renovation PLA contain special provisions for JOCS or task order based Contracts?

A. The PLA does not apply to Task Orders or Work Orders that do not exceed $10,000 issued under JOCS or Requirements Contracts otherwise subject to the PLA. See PLA Article 3, Section 1.

NYC Project Labor Agreements

CONTACT INFORMATION FOR LOCAL UNIONS (Updated May 2016)

BOILER MAKERS LOCAL NO. 5
24 Van Siclen Avenue
Floral Park, NY 11001
Phone: (516) 326-2500
Fax: (516) 326-3435
Business Manager: Steve Ludwigson

BLASTERS, DRILLRUNNERS & MINERS LOCAL NO. 29
43-12 Ditmars Blvd.
Astoria, NY, 11105
Phone: (718) 278-5800
Business Manager: Thomas Russo

BRICKLAYERS LOCAL NO. 1
4 Court Square #1
Long Island City, NY 11101
Phone: (718) 392-0525
Business Manager: Jeramiah Sullivan

CARPENTERS DISTRICT COUNCIL
395 Hudson Street, 9th Fl
New York, New York 10014
Phone: (212) 366-7500
Fax: (212) 675-3140
Business Manager: Joe Geiger
John Sheehy, D.C. Rep.

CEMENT MASONS NO. 780
150-50 14th Rd Suite 4
Whitestone, NY 11357
Phone: (718) 357-3750
Fax: (718) 357-2057
Business Manager: Gino Castingnoli

CONCRETE WORKERS
DISTRICT COUNCIL NO. 16
29-18 35th Avenue
Long Island City, NY 11106
Phone: (718) 392-5077
Fax: (718) 392-5087
Business Manager: Alex Castaldi

DERRICKMEN & RIGGERS LOCAL 197
35-53 24th Street
Long Island City, NY 11101
Phone: (718) 361-6534
Fax: (718) 361-6584
Business Manager: William Hayes
Billhayes197@yahoo.com

DRYWALL TAPERS 1974
265 West 14th Street
New York, NY 10011
Phone: (212) 242-8500
Fax: (212) 242-2356
Business Manager: Sal Marsala

ELECTRICAL LOCAL NO. 3
158-11 Harry Van Arsdale, Jr. Avenue
Flushing, NY 11365
Phone: (718) 591-4000
Fax: (718) 380-8998
Business Manager: Chris Erickson
Raymond Melville, Asst. Bus. Mgr.
Construction

ELEVATOR CONSTRUCTORS NO. 1
47-24 27th Avenue
Long Island City, NY 11101
Phone: (718) 767-7004
Fax: (718) 767-6730
Business Manager: Lenny Legotte
llegotte@localoneiuec.com

ENGINEERS LOCAL NO. 14
141-57 Northern Boulevard
Flushing, NY 11354
Phone: (718) 939-0600
Fax: (718) 939-3131
Business Manager: Edwin Christian

ENGINEERS NO. 15, 15A, 15B, 15C, 15D
44-40 11th Street
Long Island City, NY 11101
Phone: (212) 929-5327
Business Manager: Tom Callahan

ENGINEERS NO. 30
16-16 Whitestone Expressway
Whitestone, NY 11357
Phone: (718) 847-8484
Fax: (718) 850-0524
Business Manager: William Lynn

ENGINEERS No. 94
331-337 West 44th Street
New York, NY 10036
Phone: (212) 245-7040
Fax: (212) 245-7886
Business Manager: Kuba Brown
kubabrown@local94.com

GLAZIERS NO. 1087
45 West 14th Street
New York, NY 10011
Phone: (212) 924-5200
Fax: (212) 255-1151
Business Manager: Steve Birmingham

HEAT & FROST INSULATORS AND ALLIED WORKERS LOCAL UNION NO. 12
35-53 24th Street
Long Island City, NY 11101
Phone: (718) 784-3456
Fax: (718) 784-8357
Business Manager: Matty Aracich
matty@insulatorslocal12.com

HEAT & FROST INSULATORS LOCAL UNION NO. 12A
1536 127th Street
College Point, NY 11356
Phone: (718) 886-7226
Business Manager: Jaime Soto

IRON WORKERS DISTRICT COUNCIL
22 West 46th Street
New York, NY 10036
Phone: (212) 302-1868
Business Manager: James Mahoney
jmahoney@iwintl.org

IRON WORKERS NO. 40 (Manhattan, The Bronx & Staten Island)
451 Park Avenue South
New York, NY 10016
Phone: (212) 889-1320
Fax: (212) 779-3267
Business Manager: Bob Walsh

IRON WORKERS NO. 361 (Brooklyn & Queens)
89-19 97th Avenue
Ozone Park, NY 11416
Phone: (718) 322-1016/17
Fax: (718) 322-1053
Business Manager: Matthew Chartrand

LABORERS LOCAL NO. 78
ASBESTOS & LEAD ABATEMENT
30 Cliff Street
New York, New York 10038
Phone: (212) 227-4803
Fax: (212) 406-1800
Business Manager: Edison Severino

LABORERS, CONSTRUCTION AND
GENERAL BUILDING NO. 79
520 8th Avenue
New York, NY 10018
Phone: (212) 465-7900
Fax: (212- 465-7903
Business Manager: Michael Prohaska

LABORERS NO. 731
34-11 35th Avenue
Astoria, NY 11106
(718) 706-0720
Business Manager: Joseph D'Amato

LATHERS METAL
LOCAL NO. 46
1322 Third Avenue
New York, NY 10021
Phone: (212) 737-0500
Fax: (212) 249-1226
Business Manager: Terrance Moore

MASON TENDERS DIST. COUNCIL
520 8th Avenue
New York, NY 10018
Phone: (212) 452-9400
Fax: (212) 452-9499
Business Manager: Robert Bonanza

METAL POLISHERS
LOCAL UNION NO. 8A-28A
36-18 33rd Street 2nd Fl.
Long Island City, NY 11106
Phone: (718) 361-1770
Fax: (718) 361-1934
Business Manager: Hector Lopez

MILLWRIGHT AND MACHINERY
ERECTORS LOCAL NO. 740
89-07 Atlantic Avenue
Woodhaven, NY 11412
Phone: (718) 849-3636
Fax: (718) 849-0070
Business Manager: Joseph Geiger

ORNAMENTAL IRON WORKERS
NO. 580
501 West 42nd Street
New York, NY 10036
Phone: (212) 594-1662
Fax: (212) 564-2748
Business Manager: Pete Myers

PAINTERS DISTRICT
COUNCIL NO. 9
45 West 14th Street
New York, NY 10011
Phone: (212) 255-2950
Fax: (212) 255-1151
Business Manager: Joseph Azzopardi

PAINTERS STRUCTURAL STEEL
NO. 806
40 West 27th Street
New York, New York 10001
Phone: (212) 447-1838/0149
Fax: (212) 545-8386
Business Manager: Angelo Serse

PAVERS & ROAD BUILDERS
DISTRICT COUNCIL NO. 1
136-25 37th Avenue, Suite 502
Flushing, NY 11354
Phone: (718) 886-3310
Business Manager: Keith Lozcalzo

PLASTERS LOCAL UNION NO. 262
2241 Conner Street
Bronx, NY 10466
Phone: (718) 547-5440
Fax: (718) 547-5435
Business Manager: Michael Hubler

PLUMBERS NO. 1
158-29 Cross Bay Boulevard
Howard Beach, NY 11414
Phone: (718) 738-7500
Fax: (718) 835-0896
Business Manager: John Murphy

PRIVATE SANITATION
LOCAL NO. 813
45-18 Court Square, Suite 600
Long Island City, NY 11101
Phone: (718) 937-7010 ext. 244
Fax: (718) 937-7003
Business Manager: Sean Campbell

ROOFERS & WATERPROOFERS NO. 8
12-11 43rd Avenue
Long Island City, NY 11101
Phone: (718) 361-1169
Fax (718) 361-8330
Business Manager: Nick Siciliano

SHEET METAL WORKERS
LOCAL NO. 28
MANHATTAN OFFICE
500 Greenwich Street
New York, NY 10013
Phone: (212) 941-7700
Fax: (212) 226-0304
Business Manager: Kevin Connors

SHEET METAL WORKERS
LOCAL 137
21-42 44th Drive
Long Island City, NY 11101
Phone: (718) 937-4514
Fax: (718) 937-4113
Business Manager: Dante Dano

STEAMFITTERS LOCAL UNION
NO. 638
32-32 48th Avenue
Long Island City, NY 11101
Phone: (718) 392-3420
Fax: (718) 784-7285
Business Manager: Bob Bartels

TEAMSTERS LOCAL UNION 282
2500 Marcus Avenue
Lake Success, NY 11042
Phone: (516) 488-2822
Fax: (516) 488-4895
Business Manager: Tom Gesauldi

TEAMSTERS LOCAL UNION 814
21-42 44th Drive
Long Island City, NY 11101
Phone: (718) 609-6407
Fax: (718) 361-9610
Business Manager: Jason Ide

TILE, MARBLE & TERRAZO B.A.C.
LOCAL UNION 7
45-34 Court Square
Long Island City, NY 11101
Phone: (718) 786-7648
Fax: (718) 472-2370
Business Manager: Tom Lane

TIMBERMEN & DOCKBUILDERS LOCAL 1556
395 Hudson Street
New York, NY 10014
Phone: (212) 242-1320
Business Manager: Joseph Geiger

PROJECT LABOR AGREEMENT

COVERING NEW CONSTRUCTION

OF IDENTIFIED CITY OWNED

BUILDINGS AND STRUCTURES

2015 - 2018

TABLE OF CONTENTS

Page

ARTICLE 1 - PREAMBLE 1

SECTION 1. PARTIES TO THE AGREEMENT 2

ARTICLE 2 - GENERAL CONDITIONS 3

SECTION 1. DEFINITIONS 3

SECTION 2. CONDITIONS FOR AGREEMENT TO BECOME EFFECTIVE 3

SECTION 3. ENTITIES BOUND & ADMINISTRATION OF AGREEMENT 4

SECTION 4. SUPREMACY CLAUSE 4

SECTION 5. LIABILITY 5

SECTION 6. THE AGENCY 5

SECTION 7. AVAILABILITY AND APPLICABILITY TO ALL SUCCESSFUL BIDDERS 6

SECTION 8. SUBCONTRACTING 6

ARTICLE 3-SCOPE OF THE AGREEMENT 6

SECTION 1. WORK COVERED 6

SECTION 2. TIME LIMITATIONS 8

SECTION 3. EXCLUDED EMPLOYEES 8

SECTION 4. NON-APPLICATION TO CERTAIN ENTITIES 10

ARTICLE 4- UNION RECOGNITION AND EMPLOYMENT 10

SECTION 1. PRE-HIRE RECOGNITION 10

SECTION 2. UNION REFERRAL 11

SECTION 3. NON-DISCRIMINATION IN REFERRALS 13

SECTION 4: MINORITY AND FEMALE REFERRALS 13

SECTION 5. CROSS AND QUALIFIED REFERRALS 14

SECTION 6. UNION DUES 14

SECTION 7. CRAFT FOREPERSONS AND GENERAL FOREPERSONS 15

SECTION 8. ON CALL REPAIR REFERRALS 15

ARTICLE 5- UNION REPRESENTATION **17**

SECTION 1. LOCAL UNION REPRESENTATIVE 17

SECTION 2. STEWARDS 17

SECTION 3. LAYOFF OF A STEWARD 18

ARTICLE 6- MANAGEMENT'S RIGHTS **18**

SECTION 1. RESERVATION OF RIGHTS 18

SECTION 2. MATERIALS, METHODS & EQUIPMENT 19

ARTICLE 7- WORK STOPPAGES AND LOCKOUTS **20**

SECTION 1. NO STRIKES-NO LOCK OUT 20

SECTION 2. DISCHARGE FOR VIOLATION 21

SECTION 3. NOTIFICATION 21

SECTION 4. EXPEDITED ARBITRATION 21

SECTION 5. ARBITRATION OF DISCHARGES FOR VIOLATION 23

ARTICLE 8 - LABOR MANAGEMENT COMMITTEE **24**

SECTION 1. SUBJECTS 24

SECTION 2. COMPOSITION 24

ARTICLE 9- GRIEVANCE & ARBITRATION PROCEDURE **24**

SECTION 1. PROCEDURE FOR RESOLUTION OF GRIEVANCES 24

SECTION 2. LIMITATION AS TO RETROACTIVITY 27

SECTION 3. PARTICIPATION BY AGENCY AND/OR CONSTRUCTION MANAGER 28

ARTICLE 10 - JURISDICTIONAL DISPUTES **28**

SECTION 1. NO DISRUPTIONS 28

SECTION 2. ASSIGNMENT 28

SECTION 3. NO INTERFERENCE WITH WORK 29

ARTICLE 11 - WAGES AND BENEFITS **29**

SECTION 1. CLASSIFICATION AND BASE HOURLY RATE 29

SECTION 2. EMPLOYEE BENEFITS 29

ARTICLE 12- HOURS OF WORK, PREMIUM PAYMENTS, SHIFTS AND HOLIDAYS **35**

SECTION 1. WORK WEEK AND WORK DAY 35

SECTION 2. OVERTIME 36

SECTION 3. SHIFTS 36

SECTION 4. HOLIDAYS 37

SECTION 5. SATURDAY WORK 38

SECTION 6. REPORTING PAY 38

SECTION 7. PAYMENT OF WAGES 39

SECTION 8. EMERGENCY WORK SUSPENSION 40

SECTION 9. INJURY/DISABILITY 40

SECTION 10. TIME KEEPING 40

SECTION 11. MEAL PERIOD 40

SECTION 12. BREAK PERIODS 41

ARTICLE 13 - APPRENTICES **41**

SECTION 1. RATIOS 41

ARTICLE 14-SAFETY PROTECTION OF PERSON AND PROPERTY **42**

SECTION 1. SAFETY REQUIREMENTS 42

SECTION 2. CONTRACTOR RULES 42

SECTION 3. INSPECTIONS 43

ARTICLE 15 - TEMPORARY SERVICES **43**

ARTICLE 16 - NO DISCRIMINATION **43**

SECTION 1. COOPERATIVE EFFORTS 43

SECTION 2. LANGUAGE OF AGREEMENT 44

ARTICLE 17- GENERAL TERMS **44**

SECTION 1. PROJECT RULES 44

SECTION 2. TOOLS OF THE TRADE 44

SECTION 3. SUPERVISION 45

SECTION 4. TRAVEL ALLOWANCES 45

SECTION 5. FULL WORK DAY 45

SECTION 6. COOPERATION AND WAIVER 45

ARTICLE 18. SAVINGS AND SEPARABILITY **46**

SECTION 1. THIS AGREEMENT 46

SECTION 2. THE BID SPECIFICATIONS 47

SECTION 3. NON-LIABILITY 47

SECTION 4. NON-WAIVER 48

ARTICLE 19 - FUTURE CHANGES IN SCHEDULE A AREA CONTRACTS **48**

SECTION 1. CHANGES TO AREA CONTRACTS 48

SECTION 2. LABOR DISPUTES DURING AREA CONTRACT NEGOTIATIONS 49

ARTICLE 20 - WORKERS' COMPENSATION ADR **49**

SECTION 1. 49

ARTICLE 21 - HELMETS TO HARDHATS **49**

SECTION 1. 49

SECTION 2. 49

Project Labor Agreement - - Letter of Assent 52

New York City Building And Construction Trades Council Standards of Excellence 54

PROJECT LABOR AGREEMENT COVERING IDENTIFIED NEW CONSTRUCTION OF NEW YORK CITY OWNED FACILITIES & STRUCTURES

ARTICLE 1 - PREAMBLE

WHEREAS, the City of New York desires to provide for the cost efficient, safe, quality, and timely completion of certain new construction ("Program Work," as defined in Article 3) in a manner designed to afford the lowest costs to the Agencies covered by this Agreement, and the Public it represents, and the advancement of permissible statutory objectives;

WHEREAS, this Project Labor Agreement will foster the achievement of these goals, inter alia, by:

(1) providing a mechanism for responding to the unique construction needs associated with this Program Work and achieving the most cost effective means of construction, including direct labor cost savings, by the Building and Construction Trades Council of Greater New York and Vicinity and the signatory Local Unions and their members waiving various shift and other hourly premiums and other work and pay practices which would otherwise apply to Program Work;

(2) expediting the construction process and otherwise minimizing the disruption to the covered Agencies' ongoing operations at the facilities that are the subject of the Agreement;

(3) avoiding the costly delays of potential strikes, slowdowns, walkouts, picketing and other disruptions arising from work disputes, reducing jobsite friction on common situs worksites, and promoting labor harmony and peace for the duration of the Program Work;

(4) standardizing the terms and conditions governing the employment of labor on Program Work;

(5) permitting wide flexibility in work scheduling and shift hours and times to allow maximum work to be done during off hours yet at affordable pay rates;

(6) permitting adjustments to work rules and staffing requirements from those which otherwise might obtain;

(7) providing comprehensive and standardized mechanisms for the settlement of work disputes, including those relating to jurisdiction;

(8) ensuring a reliable source of skilled and experienced labor; and

(9) securing applicable New York State Labor Law exemptions.

WHEREAS, the Building and Construction Trades Council of Greater New York and Vicinity, its participating affiliated Local Unions and their members, desire to assist the City in meeting these operational needs and objectives as well as to provide for stability, security and work opportunities which are afforded by this Project Labor Agreement; and

WHEREAS, the Parties desire to maximize Program Work safety conditions for both workers and the community in the project area.

NOW, THEREFORE, the Parties enter into this Agreement:

SECTION 1. PARTIES TO THE AGREEMENT

This is a Project Labor Agreement ("Agreement") entered into by the City of New York, acting through the Department of Design and Construction, on behalf of itself and the Agencies covered herein, including in their capacity as construction manager of covered projects and/or on behalf of any third party construction manager which may be utilized, and the Building and Construction Trades Council of Greater New York and Vicinity ("Council") (on behalf of itself) and the signatory affiliated Local Union's ("Unions" or "Local Unions"). The Council and each signatory Local Union hereby warrants and represents that it has been duly authorized to enter into this Agreement.

ARTICLE 2 - GENERAL CONDITIONS

SECTION 1. DEFINITIONS

Throughout this Agreement, the various Union parties including the Building and Construction Trades Council of Greater New York and Vicinity and its participating affiliated Local Unions, are referred to singularly and collectively as "Union(s)" or "Local Unions"; the term "Contractor(s)" shall include any Construction Manager, General Contractor and all other contractors, and subcontractors of all tiers engaged in Program Work within the scope of this Agreement as defined in Article 3; "Agency" means means the New York City Department of Design and Construction (DDC) or such other City agency that executes an addendum pursuant to Article 3, Section 1 of this Agreement; the New York City Agency that awards a particular contract subject to this Agreement may be referred to hereafter as the "Agency"; when an Agency acts as Construction Manager, unless otherwise provided, it has the rights and obligations of a "Construction Manager" in addition to the rights and obligations of an Agency; the Building and Construction Trades Council of Greater New York and Vicinity is referred to as the ["BCTC" or "Council"]; and the work covered by this Agreement (as defined in Article 3) is referred to as "Program Work."

SECTION 2. CONDITIONS FOR AGREEMENT TO BECOME EFFECTIVE

This Agreement shall not become effective unless each of the following conditions are met: the Agreement is executed by (1) the Council, on behalf of itself, (2) the participating affiliated Local Unions; and (3) the Commissioner of the Department of Design and Construction or his designee.

SECTION 3. ENTITIES BOUND & ADMINISTRATION OF AGREEMENT

This Agreement shall be binding on all participating Unions and their affiliates, the Construction Manager (in its capacity as such) and all Contractors of all tiers performing Program Work, as defined in Article 3. The Contractors shall include in any subcontract that they let for performance during the term of this Agreement a requirement that their subcontractors, of all tiers, become signatory and bound by this Agreement with respect to that subcontracted work falling within the scope of Article 3 and all Contractors (including subcontractors) performing Program Work shall be required to sign a "Letter of Assent" in the form annexed hereto as Exhibit "A". This Agreement shall be administered by the applicable Agency or a Construction Manager or such other designee as may be named by the Agency or Construction Manager, on behalf of all Contractors.

SECTION 4. SUPREMACY CLAUSE

This Agreement, together with the local Collective Bargaining Agreements appended hereto as Schedule A, represents the complete understanding of all signatories and supersedes any national agreement, local agreement or other collective bargaining agreement of any type which would otherwise apply to this Program Work, in whole or in part, except that Program Work which falls within the jurisdiction of the Operating Engineers Locals 14 and 15 will be performed under the terms and conditions set out in the Schedule A agreements of Operating Engineers Locals 14 and 15. The Collective Bargaining Agreements of the affiliated local unions that cover the particular type of construction work to be performed by the contractor, and as set forth in the Schedule A list of Agreements, shall be deemed the Schedule A Collective Bargaining Agreements ("Schedule A CBA") under this Agreement. Where association and independent

Collective Bargaining Agreements for a particular type of construction work are both set forth in Schedule A, association members shall treat the applicable association agreement as the Schedule A CBA and independent contractors shall treat the applicable independent agreement as the Schedule A CBA. Subject to the foregoing, where a subject covered by the provisions of this Agreement is also covered by a Schedule A Collective Bargaining Agreement, the provisions of this Agreement shall prevail. It is further understood that no Contractor shall be required to sign any other agreement as a condition of performing Program Work. No practice, understanding or agreement between a Contractor and a Local Union which is not set forth in this Agreement shall be binding on this Program Work unless endorsed in writing by the Construction Manager or such other designee as may be designated by the Agency.

SECTION 5. LIABILITY

The liability of any Contractor and the liability of any Union under this Agreement shall be several and not joint. The Construction Manager and any Contractor shall not be liable for any violations of this Agreement by any other Contractor; and the Council and Local Unions shall not be liable for any violations of this Agreement by any other Union.

SECTION 6. THE AGENCY

The Agency (or Construction Manager where applicable) shall require in its bid specifications for all Program Work within the scope of Article 3 that all successful bidders, and their subcontractors of all tiers, become bound by, and signatory to, this Agreement. The Agency (or Construction Manager) shall not be liable for any violation of

this Agreement by any Contractor. It is understood that nothing in this Agreement shall be construed as limiting the sole discretion of the Agency or Construction Manager in determining which Contractors shall be awarded contracts for Program Work. It is further understood that the Agency or Construction Manager has sole discretion at any time to terminate, delay or suspend the Program Work, in whole or part, on any Program.

SECTION 7. AVAILABILITY AND APPLICABILITY TO ALL SUCCESSFUL BIDDERS

The Unions agree that this Agreement will be made available to, and will fully apply to, any successful bidder for (or subcontractor of) Program Work who becomes signatory thereto, without regard to whether that successful bidder (or subcontractor) performs work at other sites on either a union or non-union basis and without regard to whether employees of such successful bidder (or subcontractor) are, or are not, members of any unions. This Agreement shall not apply to the work of any Contractor which is performed at any location other than the site of Program Work.

SECTION 8. SUBCONTRACTING

Contractors will subcontract Program Work only to a person, firm or corporation who is or agrees to become party to this Agreement.

ARTICLE 3-SCOPE OF THE AGREEMENT

SECTION 1. WORK COVERED

Program Work shall be limited to construction contracts bid and let by the Agency (or its Construction Manager where applicable) after the effective date of this Agreement (and prior to December 31, 2018) for that new construction on any Project for which an

addendum has been issued pursuant to the provisions set forth below. Additional Projects may be added to this Agreement through a Project specific Addendum approved by an agency of the City of New York and by the BCTC on behalf of itself and its affiliated Local Unions. Each Project specific addendum is to outline and include a description of the project being undertaken, the project's location, and the general findings of the Feasibility Analysis used as the basis of the determination to utilize a PLA on the project.

It is understood that, except where the City specifically applies this Project Labor Agreement to such work in its bid documents, Program Work does not include, and this Project Labor Agreement shall not apply to, any other work, including:

1. Contracts let and work performed under contracts bid prior to the effective date of this Agreement and all contracts let after December 31, 2018;

2. Contracts procured on an emergency basis;

3. Contracts that do not exceed $250,000;

4. Contracts with electric utilities, gas utilities, telephone companies, and railroads, except that it is understood and agreed that these entities may only install their work to a demarcation point, e.g. a telephone closet or utility vault, the location of which is determined prior to construction and employees of such entities shall not be used to replace employees performing Program Work pursuant to this agreement;

5. Contracts for installation of information technology that are not otherwise Program Work; and

6. Contracts that do not exceed $1 Million that are awarded pursuant to

prequalified lists (PQLs) established by City agencies where entry on to the PQL is restricted to MWBEs, or a combination of MWBEs together with joint ventures which include at least one MWBE, or contractors who agree to subcontract at least 50% of the contract to MWBEs.

SECTION 2. TIME LIMITATIONS

In addition to falling within the scope of Article 3, Section 1, to be covered by this Agreement Program Work must be (1) advertised and let for bid after the effective date of this Agreement, and (2) let for bid prior to December 31, 2018, the expiration date of this Agreement. It is understood that this Agreement, together with all of its provisions, shall remain in effect for all such Program Work until completion, even if not completed by the expiration date of the Agreement. If Program Work otherwise falling within the scope of Article 3, Section 1 is not let for bid by the expiration date of this Agreement, this Agreement may be extended to that work by mutual agreement of the parties.

SECTION 3. EXCLUDED EMPLOYEES

The following persons are not subject to the provisions of this Agreement, even though performing Program Work:

A. Superintendents, supervisors (excluding general and forepersons specifically covered by a craft's Schedule A), engineers, professional engineers and/or licensed architects engaged in inspection and testing, quality control/assurance personnel, timekeepers, mail carriers, clerks, office workers, messengers, guards, technicians, non-manual employees, and all professional, engineering, administrative and management persons;

B. Employees of the Agency, New York City, or any other municipal or State agency, authority or entity, or employees of any other public employer, even though working on the Program site while covered Program Work is underway;

C. Employees and entities engaged in off-site manufacture, modifications, repair, maintenance, assembly, painting, handling or fabrication of project components, materials, equipment or machinery or involved in deliveries to and from the Program site, except to the extent they are lawfully included in the bargaining unit of a Schedule A agreement;

D. Employees of the Construction Manager (except that in the event the Agency engages a Contractor to serve as Construction Manager, then those employees of the Construction Manager performing manual, on site construction labor will be covered by this Agreement);

E. Employees engaged in on-site equipment warranty work unless employees are already working on the site and are certified to perform warranty work;

F. Employees engaged in geophysical testing other than boring for core samples;

G. Employees engaged in laboratory, specialty testing, or inspections, pursuant to a professional services agreement between the Agency, or any of the Agency's other professional consultants, and such laboratory, testing, inspection or surveying firm; and

H. Employees engaged in on-site maintenance of installed equipment or systems which maintenance is awarded as part of a contract that includes Program Work

but which maintenance occurs after installation of such equipment or system and is not directly related to construction services.

SECTION 4. NON-APPLICATION TO CERTAIN ENTITIES

This Agreement shall not apply to those parents, affiliates, subsidiaries, or other joint or sole ventures of any Contractor which do not perform Program Work. It is agreed that this Agreement does not have the effect of creating any joint employment, single employer or alter ego status among the Agency (including in its capacity as Construction Manager) or any Contractor. The Agreement shall further not apply to any New York City or other municipal or State agency, authority, or entity other than a listed Agency and nothing contained herein shall be construed to prohibit or restrict the Agency or its employees, or any State, New York City or other municipal or State authority, agency or entity and its employees, from performing on or off-site work related to Program Work.

As the contracts involving Program Work are completed and accepted, the Agreement shall not have further force or effect on such items or areas except where inspections, additions, repairs, modifications, check-out and/or warranty work are assigned in writing (copy to Local Union involved) by the Agency (or Construction Manager) for performance under the terms of this Agreement.

ARTICLE 4- UNION RECOGNITION AND EMPLOYMENT

SECTION 1. PRE-HIRE RECOGNITION

The Contractors recognize the signatory Unions as the sole and exclusive bargaining representatives of all employees who are performing on-site Program Work, with respect to that work.

SECTION 2. UNION REFERRAL

A. The Contractors agree to employ and hire craft employees for Program Work covered by this Agreement through the job referral systems and hiring halls established in the Local Unions area collective bargaining agreements. Notwithstanding this, Contractors shall have sole right to determine the competency of all referrals; to determine the number of employees required; to select employees for layoff (subject to Article 5, Section 3); and the sole right to reject any applicant referred by a Local Union, subject to the show-up payments. In the event that a Local Union is unable to fill any request for qualified employees within a 48 hour period after such requisition is made by a Contractor (Saturdays, Sundays and holidays excepted), a Contractor may employ qualified applicants from any other available source. In the event that the Local Union does not have a job referral system, the Contractor shall give the Local Union first preference to refer applicants, subject to the other provisions of this Article. The Contractor shall notify the Local Union of craft employees hired for Program Work within its jurisdiction from any source other than referral by the Union.

B. A Contractor may request by name, and the Local will honor, referral of persons who have applied to the Local for Program Work and who meet the following qualifications:

(1) possess any license required by New York State law for the Program Work to be performed;

(2) have worked a total of at least 1000 hours in the Construction field during the prior 3 years; and

(3) were on the Contractor's active payroll for at least 60 out of the 180 calendar days prior to the contract award.

No more than twelve per centum (12%) of the employees covered by this Agreement, per Contractor by craft, shall be hired through the special provisions above. Under this provision, name referrals begin with the eighth employee needed and continue on that same basis.

C. Notwithstanding Section 2(B), above, certified MWBE contractors for which participation goals are set forth in New York City Administrative Code §6-129, that are not signatory to any Schedule A CBAs, with contracts valued at or under five hundred thousand ($500,000), may request by name, and the Local will honor, referral of the second (2nd), fourth (4th), sixth (6th), and eighth (8th) employee, who have applied to the Local for Program Work and who meet the following qualifications:

(1) possess any license required by New York State law for the Program Work to be performed;

(2) have worked a total of at least 1000 hours in the Construction field during the prior 3 years; and

(3) were on the Contractor's active payroll for at least 60 out of the 180 work days prior to the contract award.

For such contracts valued at above $500,000 but less than $1 million, the Local will honor referrals by name of the second (2nd), fifth (5th), and eighth (8th) employee subject to the foregoing requirements. In both cases, name referrals will thereafter be in accordance with Section 2(B), above.

D. Where a certified MWBE Contractor voluntarily enters into a Collective Bargaining Agreement ("CBA") with a BCTC Union, the employees of such Contractor at the time the CBA is executed shall be allowed to join the Union for the

applicable trade subject to satisfying the Union's basic standards of proficiency for admission.

SECTION 3. NON-DISCRIMINATION IN REFERRALS

The Council represents that each Local Union hiring hall and referral system will be operated in a non-discriminatory manner and in full compliance with all applicable federal, state and local laws and regulations which require equal employment opportunities. Referrals shall not be affected in any way by the rules, regulations, bylaws, constitutional provisions or any other aspects or obligations of union membership, policies or requirements and shall be subject to such other conditions as are established in this Article. No employment applicant shall be discriminated against by any referral system or hiring hall because of the applicant's union membership, or lack thereof.

SECTION 4: MINORITY, FEMALE, LOCAL AND SECTION 3 REFERRALS

In the event a Local Union either fails, or is unable to refer qualified minority or female applicants in percentages equaling the workforce participation goals adopted by the City and set forth in the Agency's (or, if applicable, Construction Manager's) bid specifications, within 48 hours of the request for same, the Contractor may employ qualified minority or female applicants from any other available source.

In the event that the City or a City agency determines to adopt local workforce participation goals to be set forth in an Agency's (or, if applicable Construction Manager's) bid specifications, the City and BCTC will work together to seek agreement on appropriate goals to be set forth in applicable bid documents and to be subject to the provisions of this section.

For any Program Work that may become subject to requirements under Section 3 of the Housing and Urban Development Act of 1968, as amended by the Housing and Community Development Act of 1992, and any rules, including new or revised rules, that may be published thereunder, the Local Unions will acknowledge the Section 3 obligations of the Construction Manager or Contractor, as applicable, and agree to negotiate a method to implement this Article in a manner that would allow the Construction Manager or Contractor to meet its Section 3 obligations to the greatest extent feasible, and to post any required notices in the manner required by Section 3. The parties also acknowledge that the Construction Manager and Contractor may also fulfill its Section 3 requirements on Program Work by promoting opportunities for excluded employees, as defined by Article 3, Section 3 of this Agreement, on Program Work and, to the extent permitted by Section 3, by promoting opportunities for craft and other employees on non-Program Work.

SECTION 5. CROSS AND QUALIFIED REFERRALS

The Local Unions shall not knowingly refer to a Contractor an employee then employed by another Contractor working under this Agreement. The Local Unions will exert their utmost efforts to recruit sufficient numbers of skilled and qualified crafts employees to fulfill the requirements of the Contractor.

SECTION 6. UNION DUES

All employees covered by this Agreement shall be subject to the union security provisions contained in the applicable Schedule A local agreements, as amended from time to time, but only for the period of time during which they are performing on-site Program Work and only to the extent of tendering payment of the applicable union dues

and assessments uniformly required for union membership in the Local Unions which represent the craft in which the employee is performing Program Work. No employee shall be discriminated against at any Program Work site because of the employee's union membership or lack thereof. In the case of unaffiliated employees, the dues payment will be received by the Local Unions as an agency shop fee.

SECTION 7. CRAFT FOREPERSONS AND GENERAL FOREPERSONS

The selection of craft forepersons and/or general forepersons and the number of forepersons required shall be solely the responsibility of the Contractor except where otherwise provided by specific provisions of an applicable Schedule A, and provided that all craft forepersons shall be experienced and qualified journeypersons in their trade as determined by the appropriate Local Union. All forepersons shall take orders exclusively from the designated Contractor representatives. Craft forepersons shall be designated as working forepersons at the request of the Contractor, except when an existing local Collective Bargaining Agreement prohibits a foreperson from working when the craft persons he is leading exceed a specified number.

SECTION 8. ON CALL REPAIR REFERRALS

A. When an Agency awards a contract that requires the Contractor to have employees available on short notice to make time sensitive repairs with such contract requiring the Contractor to respond within as little as two hours from the time the Contractor is contacted by the Agency ("On Call, Repair Contract"), the Contractor will, within ten (10) days of being awarded an On Call Repair Contract subject to this agreement, notify the appropriate affiliated Union that it has been awarded such a contract

and immediately enter into good faith negotiations with such relevant affiliated Union to establish a procedure to receive time sensitive referrals from such affiliated Union(s).

B. In the event the Contractor and the relevant affiliated Union(s) are unable to negotiate a specific, mutually agreeable procedure for on call repair referral procedure within twenty (20) days of commencement of negotiations or prior to commencement of performance of the contract, whichever is earlier, the Contractor and the relevant affiliated Unions will follow the following procedure:

1. Upon notification by a Contractor that it has been awarded an On Call Repair Contract pursuant to paragraph A above, each relevant affiliate Union shall provide the Contractor with the name and twenty four (24) hour contact information of an On Call, Repair Contract contact person for urgent on call repair referrals.

2. The relevant affiliated Unions shall prepare a list of individuals eligible and prepared for referral on an immediate basis to respond to the on call repair contractor. Such list shall be provided to and in the possession of the designated on call repair contact person for the affiliated Union and available for immediate reference.

3. Individuals on such list must be able to comply with the Contractor's response time pursuant to contract requirements.

4. The Union's On Call, Repair Contract contact person shall respond to a contractor's request for referrals within a reasonable time of the request so that compliance with the contract shall be possible.

C. In the event that the Contractor makes a request for an on call referral that is compliant with this procedure and a Union is not able to respond to the

request, that Union will be deemed to have waived the forty-eight (48) hour referral rule contained in Section 2 above and the Contractor may employ qualified applicants from any other available source that can meet contract requirements for that time sensitive on call repair work only; provided, however, that any work related to the repair work that is not of a time sensitive nature under the contract shall comply with Section 2. If a Union fails to timely refer a worker and the Contractor employs other workers, the Contractor will e-mail the agency within 72 hours and the agency will forward that e-mail to the designated Labor Management Committee contacts.

ARTICLE 5- UNION REPRESENTATION

SECTION 1. LOCAL UNION REPRESENTATIVE

Each Local Union representing on-site employees shall be entitled to designate in writing (copy to Contractor involved and Construction Manager) one representative, and/or the Business Manager, who shall be afforded access to the Program Work site during such time as bargaining unit work is occurring and subject to otherwise applicable policies pertaining to visitors to the site.

SECTION 2. STEWARDS

A. Each Affiliated Union shall have the sole discretion to designate any journey person as a Steward and an alternate Steward. The Union shall notify the Owner and/or Construction Manager as well as the Contractor of the identity of the designated Steward (and alternate) prior to the assumption of such duties. Stewards shall not exercise supervisory functions and will receive the regular rate of pay for their craft classifications. All Stewards shall be working Stewards.

B. In addition to their work as an employee, the Steward shall have the right to receive complaints or grievances and to discuss and assist in their adjustment with the Contractor's appropriate supervisor. Each Steward shall be concerned with the employees of the Steward's trade and, if applicable, subcontractors of their Contractor, but not with the employees of any other trade Contractor. No Contractor shall discriminate against the Steward in the proper performance of Union duties.

C. The Stewards shall not have the right to determine when overtime shall be worked, or who shall work overtime except pursuant to a Schedule A provision providing procedures for the equitable distribution of overtime.

SECTION 3. LAYOFF OF A STEWARD

Contractors agree to notify the appropriate Union 24 hours prior to the layoff of a Steward, except in cases of discipline or discharge for just cause. If a Steward is protected against layoff by a Schedule A provision, such provision shall be recognized to the extent the Steward possesses the necessary qualifications to perform the work required. In any case in which a Steward is discharged or disciplined for just cause, the Local Union involved shall be notified immediately by the Contractor.

ARTICLE 6- MANAGEMENT'S RIGHTS

SECTION 1. RESERVATION OF RIGHTS

Except as expressly limited by a specific provision of this Agreement, Contractors retain full and exclusive authority for the management of their operations including, but not limited to, the right to: direct the work force, including determination as to the number of employees to be hired and the qualifications therefore; the promotion,

transfer, layoff of its employees; require compliance with the directives of the Agency including standard restrictions related to security and access to the site that are equally applicable to Agency employees, guests, or vendors; or the discipline or discharge for just cause of its employees; assign and schedule work; promulgate reasonable Program Work rules that are not inconsistent with this Agreement or rules common in the industry and are reasonably related to the nature of work; and, the requirement, timing and number of employees to be utilized for overtime work. No rules, customs, or practices which limit or restrict productivity or efficiency of the individual, as determined by the Contractor, Agency and/or Construction Manager and/or joint working efforts with other employees shall be permitted or observed.

SECTION 2. MATERIALS, METHODS & EQUIPMENT

There shall be no limitation or restriction upon the Contractor's choice of materials, techniques, methods, technology or design, or, regardless of source or location, upon the use and installation of equipment, machinery, package units, pre-cast, pre-fabricated, pre-finished, or pre-assembled materials or products, tools, or other labor-saving devices. Contractors may, without restriction, install or use materials, supplies or equipment regardless of their source; provided, however, that where there is a Schedule "A" that includes a lawful union standards and practices clauses, then such clause as set forth in Schedule A Agreements will be complied with, unless there is a lawful Agency specification (or specification issued by a Construction Manager which would be lawful if issued by the Agency directly) that would specifically limit or restrict the Contractor's choice of materials, techniques, methods, technology or design, or, regardless of source or location, upon the use and installation of equipment, machinery, package

units, pre-cast, pre-fabricated, pre-finished, or pre-assembled materials or products, tools, or other labor-saving devices, and which would prevent compliance with such Schedule A clause. The on-site installation or application of such items shall be performed by the craft having jurisdiction over such work; provided, however, it is recognized that other personnel having special qualifications may participate, in a supervisory capacity, in the installation, check-off or testing of specialized or unusual equipment or facilities as designated by the Contractor. There shall be no restrictions as to work which is performed off-site for Program Work.

ARTICLE 7- WORK STOPPAGES AND LOCKOUTS

SECTION 1. NO STRIKES-NO LOCK OUT

There shall be no strikes, sympathy strikes, picketing, work stoppages, slowdowns, hand billing, demonstrations or other disruptive activity at the Program Work site for any reason by any Union or employee against any Contractor or employer. There shall be no other Union, or concerted or employee activity which disrupts or interferes with the operation of the Program Work or the objectives of the Agency at any Program Work site. In addition, failure of any Union or employee to cross any picket line established by any Union, signatory or non-signatory to this Agreement, or the picket or demonstration line of any other organization, at or in proximity to a Program Work site where the failure to cross disrupts or interferes with the operation of Program Work is a violation of this Article. Should any employees breach this provision, the Unions will use their best efforts to try to immediately end that breach and return all employees to work. There shall be no lockout at a Program Work site by any signatory Contractor, Agency or Construction Manager.

SECTION 2. DISCHARGE FOR VIOLATION

A Contractor may discharge any employee violating Section 1, above, and any such employee will not be eligible thereafter for referral under this Agreement for a period of 100 days.

SECTION 3. NOTIFICATION

If a Contractor contends that any Union has violated this Article, it will notify the Local Union involved advising of such fact, with copies of the notification to the Council. The Local Union shall instruct and order, the Council shall request, and each shall otherwise use their best efforts to cause, the employees (and where necessary the Council shall use its best efforts to cause the Local Union), to immediately cease and desist from any violation of this Article. If the Council complies with these obligations it shall not be liable for the unauthorized acts of a Local Union or its members. Similarly, a Local Union and its members will not be liable for any unauthorized acts of the Council. Failure of a Contractor or the Construction Manager to give any notification set forth in this Article shall not excuse any violation of Section 1 of this Article.

SECTION 4. EXPEDITED ARBITRATION

Any Contractor or Union alleging a violation of Section 1 of this Article may utilize the expedited procedure set forth below (in lieu of, or in addition to, any actions at law or equity) that may be brought.

A. A party invoking this procedure shall notify J.J. Pierson or Richard Adelman; who shall alternate (beginning with Arbitrator J.J. Pierson) as Arbitrator under this expedited arbitration procedure. If the Arbitrator next on the list is not available to hear

the matter within 24 hours of notice, the next Arbitrator on the list shall be called. Copies of such notification will be simultaneously sent to the alleged violator and Council.

B. The Arbitrator shall thereupon, after notice as to time and place to the Contractor, the Local Union involved, the Council and the Construction Manager, hold a hearing within 48 hours of receipt of the notice invoking the procedure if it is contended that the violation still exists. The hearing will not, however, be scheduled for less than 24 hours after the notice required by Section 3, above.

C. All notices pursuant to this Article may be provided by telephone, telegraph, hand delivery, or fax, confirmed by overnight delivery, to the Arbitrator, Contractor, Construction Manager and Local Union involved. The hearing may be held on any day including Saturdays or Sundays. The hearing shall be completed in one session, which shall not exceed 8 hours duration (no more than 4 hours being allowed to either side to present their case, and conduct their cross examination) unless otherwise agreed. A failure of any Union or Contractor to attend the hearing shall not delay the hearing of evidence by those present or the issuance of an award by the Arbitrator.

D. The sole issue at the hearing shall be whether a violation of Section 1, above, occurred. If a violation is found to have occurred, the Arbitrator shall issue a Cease and Desist Award restraining such violation and serve copies on the Contractor and Union involved. The Arbitrator shall have no authority to consider any matter in justification, explanation or mitigation of such violation or to award damages (any damages issue is reserved solely for court proceedings, if any.) The Award shall be issued in writing within 3 hours after the close of the hearing, and may be issued without an

Opinion. If any involved party desires an Opinion, one shall be issued within 15 calendar days, but its issuance shall not delay compliance with, or enforcement of, the Award.

E. The Agency and Construction Manager (or such other designee of the Agency) may participate in full in all proceedings under this Article.

F. An Award issued under this procedure may be enforced by any court of competent jurisdiction upon the filing of this Agreement together with the Award. Notice of the filing of such enforcement proceedings shall be given to the Union or Contractor involved, and the Construction Manager.

G. Any rights created by statute or law governing arbitration proceedings which are inconsistent with the procedure set forth in this Article, or which interfere with compliance thereto, are hereby waived by the Contractors and Unions to whom they accrue.

H. The fees and expenses of the Arbitrator shall be equally divided between the involved Contractor and Union.

SECTION 5. ARBITRATION OF DISCHARGES FOR VIOLATION

Procedures contained in Article 9 shall not be applicable to any alleged violation of this Article, with the single exception that an employee discharged for violation of Section 1, above, may have recourse to the procedures of Article 9 to determine only if the employee did, in fact, violate the provisions of Section 1 of this Article; but not for the purpose of modifying the discipline imposed where a violation is found to have occurred.

ARTICLE 8 - LABOR MANAGEMENT COMMITTEE

SECTION 1. SUBJECTS

The Program Labor Management Committee will meet on a regular basis to: 1) promote harmonious relations among the Contractors and Unions; 2) enhance safety awareness, cost effectiveness and productivity of construction operations; 3) protect the public interests; 4) discuss matters relating to staffing and scheduling with safety and productivity as considerations; and 5) review efforts to meet applicable participation goals for MWBEs and workforce participation goals for minority and female employees.

SECTION 2. COMPOSITION

The Committee shall be jointly chaired by a designee of the Agency and the President of the Council. It may include representatives of the Local Unions and Contractors involved in the issues being discussed. The parties may mutually designate an MWBE representative to participate in appropriate Committee discussions. The Committee may conduct business through mutually agreed upon sub-committees.

ARTICLE 9- GRIEVANCE & ARBITRATION PROCEDURE

SECTION 1. PROCEDURE FOR RESOLUTION OF GRIEVANCES

Any question, dispute or claim arising out of, or involving the interpretation or application of this Agreement (other than jurisdictional disputes or alleged violations of Article 7, Section 1) shall be considered a grievance and shall be resolved pursuant to the exclusive procedure of the steps described below, provided, in all cases, that the question, dispute or claim arose during the term of this Agreement. Grievances shall include the City contract number and the Program Work address; such information is posted at the Program

Work Site if already commenced, and is available in the City Record and Notice to Proceed for projects not already commenced.

Grievances as to whether a scope of work is included or excluded from this Agreement shall be submitted to the Labor Management Committee (LMC) in the first instance rather than Step 1 below. To be timely, such notice must be given no later than ten days prior to a bid opening if the grievance is challenging a determination by an Agency that the contract is not subject to this Agreement. For other grievances as to contractor scope of work issues, notice of such challenges shall be submitted to the LMC within 7 calendar days after the act, occurrence or event giving rise to the grievance. If the scope of work grievance is not resolved within 21 days of its submission to the LMC, then the grievance may proceed directly to Step 3 below.

Step 1:

(a) When any employee covered by this Agreement feels aggrieved by a claimed violation of this Agreement, the employee shall, through the Local Union business representative or job steward give notice of the claimed violation to the work site representative of the involved Contractor and the Construction Manager. To be timely, such notice of the grievance must be given within 7 calendar days after the act, occurrence or event giving rise to the grievance. The business representative of the Local Union or the job steward and the work site representative of the involved Contractor shall meet and endeavor to adjust the matter within 7 calendar days after timely notice has been given. If they fail to resolve the matter within the prescribed period, the grieving party, may, within 7 calendar days thereafter, pursue Step 2 of the grievance procedure by serving the involved Contractor with written copies of the grievance setting forth a description of the

claimed violation, the date on which the grievance occurred, and the provisions of the Agreement alleged to have been violated. Grievances and disputes settled at Step 1 are non-precedential except as to the specific Local Union, employee and Contractor directly involved unless the settlement is accepted in writing by the Construction Manager (or designee) as creating a precedent.

(b) Should any signatory to this Agreement have a dispute (excepting jurisdictional disputes or alleged violations of Article 7, Section 1) with any other signatory to this Agreement and, if after conferring, a settlement is not reached within 7 calendar days, the dispute shall be reduced to writing and proceed to Step 2 in the same manner as outlined in subparagraph (a) for the adjustment of employee grievances.

Step 2:

A Step 2 grievance shall be filed with the Agency, the BCTC, the Contractor, and, if the grievance is against a subcontractor, the subcontractor. The Business Manager or designee of the involved Local Union, together with representatives of the involved Contractor, Council the Construction Manager (or designee), and, if the grievance is against a subcontractor, the subcontractor shall meet in Step 2 within 7 calendar days of service of the written grievance to arrive at a satisfactory settlement. The BCTC shall schedule the Step 2 meeting.

Step 3:

(a) If the grievance shall have been submitted but not resolved in Step 2, any of the participating Step 2 entities may, within 21 calendar days after the initial Step 2 meeting, submit the grievance in writing (copies to other participants, including the

Construction Manager or designee) to the BCTC. In the event the matter is not resolved at Step 2, either J.J. Pierson or Richard Adelman, who shall act, alternately (beginning with Arbitrator J.J. Pierson), as the Arbitrator under this procedure, shall be designated at the Step 2 hearing and the BCTC will notify the arbitrator of his designation. After such notification by the BCTC, the local demanding arbitration shall within a reasonable time request the arbitrator to schedule the matter for an arbitration hearing date. The Labor Arbitration Rules of the American Arbitration Association shall govern the conduct of the arbitration hearing, at which all Step 2 participants shall be parties. The decision of the Arbitrator shall be final and binding on the involved Contractor, Local Union and employees and the fees and expenses of such arbitrations shall be borne equally by the involved Contractor and Local Union.

(b) Failure of the grieving party to adhere to the time limits set forth in this Article shall render the grievance null and void. These time limits may be extended only by written consent of the Construction Manager (or designee), involved Contractor and involved Local Union at the particular step where the extension is agreed upon. The Arbitrator shall have authority to make decisions only on the issues presented to him and shall not have the authority to change, add to, delete or modify any provision of this Agreement.

SECTION 2. LIMITATION AS TO RETROACTIVITY

No arbitration decision or award, with the exception of those related to compliance with requirements to pay prevailing wages and supplements in accordance with federal or State law, may provide retroactivity of any kind exceeding 60 calendar days

prior to the date of service of the written grievance on the Construction Manager and the involved Contractor or Local Union.

SECTION 3. PARTICIPATION BY AGENCY AND/OR CONSTRUCTION MANAGER

The Agency and Construction Manager (or such other designee of the Agency) shall be notified by the involved Contractor of all actions at Steps 2 and 3 and, at its election, may participate in full in all proceedings at these Steps, including Step 3 arbitration.

ARTICLE 10 - JURISDICTIONAL DISPUTES

SECTION 1. NO DISRUPTIONS

There will be no strikes, sympathy strikes, work stoppages, slowdowns, picketing or other disruptive activity of any kind arising out of any jurisdictional dispute. Pending the resolution of the dispute, the work shall continue uninterrupted and as assigned by the Contractor. No jurisdictional dispute shall excuse a violation of Article 7.

SECTION 2. ASSIGNMENT

All Program Work assignments shall be made by the Contractor to unions affiliated with the BCTC consistent with the New York Plan for the Settlement of Jurisdictional Disputes ("New York Plan") and its Greenbook decisions, if any. Where there are no applicable Greenbook decisions, assignments shall be made in accordance with the provisions of the New York Plan and local industry practice.

SECTION 3. NO INTERFERENCE WITH WORK

There shall be no interference or interruption of any kind with the Program Work while any jurisdictional dispute is being resolved. The work shall proceed as assigned by the Contractor until finally resolved under the applicable procedure of this Article. The award shall be confirmed in writing to the involved parties. There shall be no strike, work stoppage or interruption in protest of any such award.

ARTICLE 11 - WAGES AND BENEFITS

SECTION 1. CLASSIFICATION AND BASE HOURLY RATE

All employees covered by this Agreement shall be classified in accordance with the work performed and paid the hourly wage rates applicable for those classifications as required by the applicable prevailing wage laws.

SECTION 2. EMPLOYEE BENEFITS

A. The Contractors agree to pay on a timely basis contributions on behalf of all employees covered by this Agreement to those established jointly trusteed employee benefit funds designated in the applicable Collective Bargaining Agreements in Schedule A (in the appropriate Schedule A amounts), provided that such benefits are required to be paid on public works under any applicable prevailing wage law. Bona fide jointly trusteed fringe benefit plans established or negotiated through collective bargaining during the life of this Agreement may be added if similarly required under applicable prevailing wage law. Contractors, not otherwise contractually bound to do so, shall not be required to contribute to benefits, trusts or plans of any kind which are not required by the prevailing wage law provided, however, that this provision does not relieve Contractors

signatory to local collective bargaining agreement with any affiliated union from complying with the fringe benefit requirements for all funds contained in the CBA.

B. 1. Notwithstanding Section 2 (A) above, and subject to 2 (B)(2) below, Contractors who designate employees pursuant to Article 4, Section 2 (B) and (C) ("core" employees) that are not signatory to a Schedule A Agreement and who maintain bona fide private benefit plans that satisfy the requirements of Section 220 of the Labor Law, may satisfy the above benefit obligation with respect to those employees by providing those employees with coverage under their private benefit plans (to the extent consistent with Section 220). The total benefit payments to be made on behalf of each such employee must be equal to the total Section 220 supplement amount and any shortfall must be paid by cash supplement to the employee.

2. A contractor that will satisfy its Section 220 obligations in accordance with subsection 2(B)(1) above shall make available to the Agency at the time of contract award a complete set of plan documents for each non-Schedule A benefit plan into which contributions will be made and/or coverage provided pursuant to the provisions of Section 2(B)(l) above. The Contractor shall also provide certification from a certified public accountant as to the annualized hourly value of such benefits consistent with the requirements of Section 220.

3. The City shall verify that the alternate benefit plan(s), together with any cash supplement to the employee, is compliant with Section 220 prior to awarding the Contractor a contract covered by this Agreement. In the event the Contractor's alternate benefit plan(s), together with any cash supplement to the employee, is determined to be

compliant with Section 220 and will be utilized by the Contractor on behalf of Article 4, Section 2(B) and (C) core employees, the Local Unions have no duty to enforce the Contractor's obligations on the alternate benefit plan(s) as they are not party to the alternate plan(s) or privy to the terms and conditions of the plan obligations. In the event the City determines the alternate benefit plan(s), together with any cash supplement to the employee, is not compliant with Section 220, the Contractor may, upon executing a Letter of Assent, satisfy its obligations for all employees, including core employees, by contributing to the Schedule A benefit plans in accordance with the terms of the Schedule A Agreements.

C. The Contractors agree to be bound by the written terms of the legally established jointly trusteed Trust Agreements specifying the detailed basis on which payments are to be paid into, and benefits paid out of, such Trust Funds but only with regard to Program Work done under this Agreement and only for those employees to whom this Agreement requires such benefit payments.

D. 1. To the extent consistent with New York City's Procurement Policy Board Rules with respect to prompt payment, as published at www.nyc.gov/ppb, §4-06(e), and in consideration of the unions' waiver of their rights to withhold labor from a contractor or subcontractor delinquent in the payment of fringe benefits contributions ("Delinquent Contractor"); the Agency agrees that where any such union and/or fringe benefit fund shall notify the Agency, the General Contractor, and the Delinquent Contractor in writing with back-up documentation that the Delinquent Contractor has

failed to make fringe benefit contributions to it as provided herein and the Delinquent Contractor shall fail, within ten (10) calendar days after receipt of such notice, to furnish either proof of such payment or notice that the amount claimed by the union and/or fringe benefit fund is in dispute, the Agency shall withhold from amounts then or thereafter becoming due and payable to the General Contractor an amount equal to that portion of such payment due to the General Contractor that relates solely to the work performed by the Delinquent Contractor which the union or fringe benefit fund claims to be due it, and shall remit the amount when and so withheld to the fringe benefit fund and deduct such payment from the amounts then otherwise due and payable to the General Contractor, which payment shall, as between the General Contractor and the Agency, be deemed a payment by the Agency to the General Contractor; provided however, that in any month, such withholding shall not exceed the amount contained in the General Contractor's monthly invoice for work performed by the Delinquent Contractor. The union or its employee benefit funds shall include in its notification of delinquent payment of fringe benefits only such amount it asserts the Delinquent Contractor failed to pay on the specific project against which the claim is made and the union or its employee benefit funds may not include in such notification any amount such Delinquent Contractor may have failed to pay on any other City or non-City project.

2. In addition, where a union or employee benefit fund gives notice to the City that a Contractor is Delinquent as defined in subsection 2(D)(1) above and the City determines that the notice includes appropriate back-up documentation that the Contractor is delinquent, the City will promptly, but not later than twenty (20) days after receipt of the

notice, provide a copy of said notice to City Agencies. In the event the City determines there is insufficient back-up documentation, it will notify the appropriate union and/or fringe benefit fund promptly, but not later than twenty (20) days after receipt of the Delinquency Notice, and shall include notice of what additional documentation is requested. Any determination by the City that there is insufficient back-up must be reasonable. This provision is intended to enhance compliance with the prevailing wage law and the PLA with respect to the payment of fringe benefits, and is not intended as a substitute for the resolution of a disputed claim pursuant to any applicable law or agreement.

The City and the relevant Agency(s) will thereafter require the Delinquent Contractor to provide cancelled checks or other equivalent proof of payment of benefit contributions that have come due, to be submitted with certified payroll reports for all Program Work covered by this Agreement on which the Delinquent Contractor is engaged, for at least a one-year period or such earlier period if the Contractor is ultimately determined not be a Delinquent Contractor. Such proof of payment when required is a condition of payment of the Delinquent Contractor's invoices by any entity, including, but not limited to, the City, the relevant Agency(s), Construction Manager, General Contractor, the prime or higher level subcontractor, as is appropriate under the Delinquent Contractor's engagement. The union and the funds shall upon request receive copies of the certified payrolls, cancelled checks, or other proof of payment from the City and/or the relevant Agency(s).

E. In the event the General Contractor or Delinquent Contractor shall notify the Agency as above provided that the claim of the union or fringe benefit fund is in

dispute, the Agency shall withhold from amounts then or thereafter becoming due and payable to the General Contractor an amount equal to that portion of such payment due to the General Contractor that relates solely to the work performed by the Delinquent Contractor that the union and/or employee benefit fund claims to be due it, pending resolution of the dispute pursuant to the union's Schedule A agreement, and the amount shall be paid to the party or parties ultimately determined to be entitled thereto, or held until the Delinquent Contractor and union or fringe benefit fund shall otherwise agree as to the disposition thereof; provided however, that such withholding shall not exceed the amount contained in the General Contractor's monthly invoice for work performed by the Delinquent Contractor. In the event the Agency shall be required to withhold amounts from a General Contractor for the benefit of more than one fringe benefit fund, the amounts so withheld in the manner and amount prescribed above shall be applied to or for such fund in the order in which the written notices of nonpayment have been received by the Agency, and if more than one such notice was received on the same day, proportionately based upon the amount of the union and/or fringe benefit fund claims received on such day. Nothing herein contained shall prevent the Agency from commencing an interpleader action to determine entitlement to a disputed payment in accordance with section one thousand six of the civil practice law and rules or any successor provision thereto.

F. Payment to a fringe benefit fund under this provision shall not relieve the General Contractor or Delinquent Contractor from responsibility for the work covered by the payment. Except as otherwise provided, nothing contained herein shall create any obligation on the part of the Agency to pay any union or fringe benefit fund, nor

shall anything provided herein serve to create any relationship in contract or otherwise, implied or expressed, between the union/fund and/or fringe benefit and the Agency.

ARTICLE 12- HOURS OF WORK, PREMIUM PAYMENTS, SHIFTS AND HOLIDAYS

SECTION 1. WORK WEEK AND WORK DAY

A. The standard work week shall consist of 40 hours of work at straight time rates, Monday through Friday, 8 hours per day, plus ½ hour unpaid lunch period.

B. In accordance with Program needs, there shall be flexible start times with advance notice from Contractor to the Union. The Day Shift shall commence between the hours of 6:00 a.m. and 9:00 a.m. and shall end between the hours of 2:30 p.m. and 5:30 p.m., for an 8 hour day. The Evening Shift shall commence between the hours of 3:00 p.m. and 6:00 p.m., unless different times are necessitated by the Agency's phasing plans on specific projects. The Night Shift shall commence between the hours of 11:00 p.m. and 2:00 a.m., unless different times are necessitated by the Agency's phasing plans on specific projects. Subject to the foregoing, starting and quitting times shall occur at the Program Work site designated by the Contractor.

C. Scheduling — Except as provided above, Monday through Friday is the standard work week; 8 hours of work plus ½ hour unpaid lunch.

D. Notice - Contractors shall provide not less than *5* days prior notice to the Local Union involved as to the work week and work hour schedules to be worked or such lesser notice as may be mutually agreed upon.

SECTION 2. OVERTIME

Overtime shall be paid for any work over eight (8) hours in a day and work over forty (40) hours in a week, at time and one half (1½) Monday through Saturday. All overtime work performed on Sunday and Holidays will be paid pursuant to the applicable Schedule A. There shall be no stacking or pyramiding of overtime pay under any circumstances. There will be no restriction upon the Contractor's scheduling of overtime or the nondiscriminatory designation of employees who shall be worked, including the use of employees, other than those who have worked the regular or scheduled work week, at straight time rates. The Contractor shall have the right to schedule work so as to minimize overtime or schedule overtime as to some, but not all, of the crafts and whether or not of a continuous nature.

SECTION 3. SHIFTS

A. Flexible Schedules - Scheduling of shift work, including Saturday and Sunday work, shall be within the discretion of the Contractor in order to meet Program Work schedules and existing Program Work conditions including the minimization of interference with the mission of the Agency. It is not necessary to work a day shift in order to schedule a second or third shift, or a second shift in order to schedule a third shift, or to schedule all of the crafts when only certain crafts or employees are needed. Shifts must have prior approval of the Agency or Construction Manager, and must be scheduled with not less than five work days notice to the Local Union or such lesser notice as may be mutually agreed upon.

B. Second and/or Third Shifts/Saturday and/or Sunday Work - - The second shift shall start between 3 p.m. and 6 p.m. and the third shift shall start between 11 p.m. and 2 a.m., subject to different times necessitated by the Agency phasing plans on specific projects. There shall be no reduction in shift hour work. All employees within a classification performing Program Work will be paid at the same wage rate regardless of the shift or work scheduled work, subject only to the foregoing provisions.

C. Flexible Starting Times - Shift starting times will be adjusted by the Contractor as necessary to fulfill Program Work requirements subject to the notice requirements of paragraph A.

SECTION 4. HOLIDAYS

A. Schedule - There shall be nine (9) recognized holidays on the Project:

New Year's Day	
Martin Luther King Day	President's Day
Memorial Day	Veteran's Day
Labor Day	Thanksgiving Day
Independence Day	Christmas Day

All said holidays shall be observed on the calendar date except those holidays which occur on Saturday shall be observed on the previous Friday and those that occur on Sunday shall be observed on the following Monday.

B. Payment - Regular holiday pay, if any, for work performed on such a recognized holiday shall be in accordance with the applicable Schedule A.

C. Exclusivity - No holidays other than those listed in Section 4(A) above shall be recognized or observed.

SECTION 5. SATURDAY WORK

The Contractor may schedule a Saturday work day and such time shall be scheduled and paid at time and one-half (1½) unless the applicable Schedule A permits a straight time rate.

SECTION 6. REPORTING PAY

A. Employees who report to the work location pursuant to their regular schedule and who are not provided with work shall be paid two hours reporting pay at straight time rates. An employee whose work is terminated early by a Contractor due to severe weather, power failure, fire or natural disaster of for similar circumstances beyond the Contractor's control, shall receive pay only for such time as is actually worked. In other instances in which an employee's work is terminated early (unless provided otherwise elsewhere in this Agreement), the employee shall be paid for his full shift. Contractors shall not be permitted to call, text or email or voicemail employees in advance of their regularly scheduled shift starting time to avoid reporting pay. Notwithstanding the above, in the event that the National Weather Service issues a weather advisory for the area in which the work location is situated, and the entire project is shut down as a result of the Weather Advisory, the contractor shall be permitted to speak to employees no less than four (4) hours in advance of their shift starting time, unless the Local Union consents to a shorter notice in writing, to advise them not to report to work due to the National Weather Service advisory, and employees who are so notified shall not receive two (2) hours

reporting pay if they report to the work location. The contractor shall make every effort to notify each employee directly and confirm that notification has been received. Voice, text, and email messages left for employees without confirmation of delivery and receipt by employee do not constitute sufficient notice under this provision.

B. When an employee, who has completed their scheduled shift and left the Program Work site, is "called out" to perform special work of a casual, incidental or irregular nature, the employee shall receive overtime pay at the rate of time and one-half of the employee's straight time rate for hours actually worked.

C. When an employee leaves the job or work location of their own volition or is discharged for cause or is not working as a result of the Contractor's invocation of Section 7 below, they shall be paid only for the actual time worked.

D. Except as specifically set forth in this Article there shall be no premiums, bonuses, hazardous duty, high time or other special premium payments or reduction in shift hours of any kind.

E. There shall be no pay for time not actually worked except as specifically set forth in this Article and except where an applicable Schedule A requires a full weeks' pay for forepersons.

SECTION 7. PAYMENT OF WAGES

A. Termination- Employees who are laid off or discharged for cause shall be paid in full for that which is due them at the time of termination. The Contractor shall also provide the employee with a written statement setting forth the date of lay off or discharge.

SECTION 8. EMERGENCY WORK SUSPENSION

A Contractor may, if considered necessary for the protection of life and/or safety of employees or others, suspend all or a portion of Program Work. In such instances, employees will be paid for actual time worked, except that when a Contractor requests that employees remain at the job site available for work, employees will be paid for that time at their hourly rate of pay.

SECTION 9. INJURY/DISABILITY

An employee who, after commencing work, suffers a work-related injury or disability while performing work duties, shall receive no less than 8 hours wages for that day. Further, the employee shall be rehired at such time as able to return to duties provided there is still Program Work available for which the employee is qualified and able to perform.

SECTION 10. TIME KEEPING

A Contractor may utilize brassing or other systems to check employees in and out. Each employee must check in and out. The Contractor will provide adequate facilities for checking in and out in an expeditious manner.

SECTION 11. MEAL PERIOD

A Contractor shall schedule an unpaid period of not more than 1/2 hour duration at the work location between the 3rd and 5th hour of the scheduled shift. A Contractor may, for efficiency of operation, establish a schedule which coordinates the meal periods of two or more crafts or which provides for staggered lunch periods within a

craft or trade. If an employee is required to work through the meal period, the employee shall be compensated in a manner established in the applicable Schedule A.

SECTION 12. BREAK PERIODS

There will be no rest periods, organized coffee breaks or other non-working time established during working hours. Individual coffee containers will be permitted at the employee's work location.

ARTICLE 13 - APPRENTICES

SECTION 1. RATIOS

Recognizing the need to maintain continuing supportive programs designed to develop adequate numbers of competent workers in the construction industry and to provide craft entry opportunities for minorities, women and economically disadvantaged non-minority males, Contractors will employ apprentices in their respective crafts to perform such work as is within their capabilities and which is customarily performed by the craft in which they are indentured. Contractors may utilize apprentices and such other appropriate classifications in the maximum ratio permitted by the New York State Department of Labor or the maximum allowed per trade. Apprentices and such other classifications as are appropriate shall be employed in a manner consistent with the provisions of the appropriate Schedule A. The parties encourage, as an appropriate source of apprentice recruitment consistent with the rules and operations of the affiliated unions' apprentice-programs, the use of the Edward J. Malloy Initiative for Construction Skills, Non-Traditional Employment for Women and Helmets to Hardhats.

ARTICLE 14-SAFETY PROTECTION OF PERSON AND PROPERTY

SECTION 1. SAFETY REQUIREMENTS

Each Contractor will ensure that applicable OSHA and safety requirements are at all times maintained on the Program Work site and the employees and Unions agree to cooperate fully with these efforts to the extent consistent with their rights and obligations under the law. Employees will cooperate with employer safety policies and will perform their work at all times in a safe manner and protect themselves and the property of the Contractor and Agency from injury or harm, to the extent consistent with their rights and obligations under the law. Failure to do so will be grounds for discipline, including discharge.

SECTION 2. CONTRACTOR RULES

Employees covered by this Agreement shall at all times be bound by the reasonable safety, security, and visitor rules as established by the Contractors and the Construction Manager for this Program Work. Such rules will be published and posted in conspicuous places throughout the Program Work sites. Any site security and access policies established by the Construction Manager or General Contractor intended for specific application to the construction workforce for Program Work and that are not established pursuant to an Agency directive shall be implemented only after notice to the BCTC and its affiliates and an opportunity for negotiation and resolution by the Labor Management Committee.

SECTION 3. INSPECTIONS

The Contractors and Construction Manager retain the right to inspect incoming shipments of equipment, apparatus, machinery and construction materials of every kind.

ARTICLE 15 - TEMPORARY SERVICES

Temporary services, i.e. all temporary heat, climate control, water, power and light, shall only be required upon the determination of the Agency or Construction Manager, and when used shall be staffed and assigned to the appropriate trade(s) with jurisdiction. Temporary services shall be provided by the appropriate Contractors' existing employees during working hours in which a shift is scheduled for employees of this Contractor. The Agency or Construction Manager may determine the need for temporary services requirements during non-working hours, and when used shall be staffed and assigned to the appropriate trades(s), and which may be limited to one person per applicable trade where practicable. There shall be no stacking of trades on temporary services, provided this does not constitute a waiver of primary trade jurisdiction. In the event a temporary system component is claimed by multiple trades, the matter shall be resolved through the New York Plan for Jurisdictional Disputes.

ARTICLE 16 - NO DISCRIMINATION

SECTION 1. COOPERATIVE EFFORTS

The Contractors and Unions agree that they will not discriminate against any employee or applicant for employment because of creed, race, color, religion, sex,

sexual orientation, national origin, marital status, citizenship status, disability, age or any other status provided by law, in any manner prohibited by law or regulation.

SECTION 2. LANGUAGE OF AGREEMENT

The use of the masculine or feminine gender in this Agreement shall be construed as including both genders.

ARTICLE 17- GENERAL TERMS

SECTION 1. PROJECT RULES

A. The Construction Manager and the Contractors shall establish such reasonable Program Work rules that are not inconsistent with this Agreement or rules common in the industry and are reasonably related to the nature of work. These rules will be explained at the pre-job conference and posted at the Program Work sites and may be amended thereafter as necessary. Notice of amendments will be provided to the appropriate Local Union. Failure of an employee to observe these rules and regulations shall be grounds for discipline, including discharge. The fact that no order was posted prohibiting a certain type of misconduct shall not be a defense to an employee disciplined or discharged for such misconduct when the action taken is for cause.

B. The parties adopt and incorporate the BCTC's Standards of Excellence as annexed hereto as Exhibit "B".

SECTION 2. TOOLS OF THE TRADE

The welding/cutting torch and chain fall are tools of the trade having jurisdiction over the work performed. Employees using these tools shall perform any of the work of the trade. There shall be no restrictions on the emergency use of any tools or

equipment by any qualified employee or on the use of any tools or equipment for the performance of work within the employee's jurisdiction.

SECTION 3. SUPERVISION

Employees shall work under the supervision of the craft foreperson or general foreperson.

SECTION 4. TRAVEL ALLOWANCES

There shall be no payments for travel expenses, travel time, subsistence allowance or other such reimbursements or special pay except as expressly set forth in this Agreement.

SECTION 5. FULL WORK DAY

Employees shall be at their work area at the starting time established by the Contractor, provided they are provided access to the work area. The signatories reaffirm their policy of a fair day's work for a fair day's wage.

SECTION 6. COOPERATION AND WAIVER

The Construction Manager, Contractors and the Unions will cooperate in seeking any NYS Department of Labor, or any other government, approvals that may be needed for implementation of any terms of this Agreement. In addition, the Council, on their own behalf and on behalf of its participating affiliated Local Unions and their individual members, intend the provisions of this Agreement to control to the greatest extent permitted by law, notwithstanding contrary provisions of any applicable prevailing wage, or other, law and intend this Agreement to constitute a waiver of any such prevailing wage, or other, law to the greatest extent permissible only for work within the scope of this

Agreement, including specifically, but not limited to those provisions relating to shift, night, and similar differentials and premiums. This Agreement does not, however, constitute a waiver or modification of the prevailing wage schedules applicable to work not covered by this Agreement.

ARTICLE 18. SAVINGS AND SEPARABILITY

SECTION 1. THIS AGREEMENT

In the event that the application of any provision of this Agreement is enjoined, on either an interlocutory or permanent basis, or is otherwise determined to be in violation of law, or if such application may cause the loss of Program funding or any New York State Labor Law exemption for all or any part of the Program Work, the provision or provisions involved (and/or its application to particular Program Work, as necessary) shall be rendered, temporarily or permanently, null and void, but where practicable the remainder of the Agreement shall remain in full force and effect to the extent allowed by law (and to the extent no funding or exemption is lost), unless the part or parts so found to be in violation of law or to cause such loss are wholly inseparable from the remaining portions of the Agreement and/or are material to the purposes of the Agreement. In the event a court of competent jurisdiction finds any portion of the Agreement to trigger the foregoing, the parties will immediately enter into negotiations concerning the substance affected by such decision for the purpose of achieving conformity with the court determination and the intent of the parties hereto for contracts to be let in the future.

SECTION 2. THE BID SPECIFICATIONS

In the event that the Agency's (or Construction Manager's) bid specifications, or other action, requiring that a successful bidder (and subcontractor) become signatory to this Agreement is enjoined, on either an interlocutory or permanent basis, or is otherwise determined to be in violation of law, or may cause the loss of Program funding or any New York State Labor Law exemption for all or any part of the Program Work, such requirement (and/or its application to particular Program Work, as necessary) shall be rendered, temporarily or permanently, null and void, but where practicable the Agreement shall remain in full force and effect to the extent allowed by law and to the extent no funding or exemption is lost). In such event, the Agreement shall remain in effect for contracts already bid and awarded or in construction only where the Agency and Contractor voluntarily accepts the Agreement. The parties will enter into negotiations as to modifications to the Agreement to reflect the court or other action taken and the intent of the parties for contracts to be let in the future.

SECTION 3. NON-LIABILITY

In the event of an occurrence referenced in Section 1 or Section 2 of this Article, neither the Agency, the Construction Manager, any Contractor, nor any Union shall be liable, directly or indirectly, for any action taken, or not taken, to comply with any court order or injunction, other determination, or in order to maintain funding or a New York State Labor Law exemption for Program Work. Bid specifications will be issued in conformance with court orders then in effect and no retroactive payments or other action will be required if the original court determination is ultimately reversed.

SECTION 4. NON-WAIVER

Nothing in this Article shall be construed as waiving the prohibitions of Article 7 as to signatory Contractors and signatory Unions.

ARTICLE 19 - FUTURE CHANGES IN SCHEDULE A AREA CONTRACTS

SECTION 1. CHANGES TO AREA CONTRACTS

A. Schedule A to this Agreement shall continue in full force and effect until the Contractor and/or Union parties to the Area Collective Bargaining Agreements that are the basis for the Schedule A notify the Agency and Construction Manager in writing of the changes agreed to in that Area Collective Bargaining which are applicable to work covered by this Agreement and their effective dates.

B. It is agreed that any provisions negotiated into Schedule A collective bargaining agreements will not apply to work under this Agreement if such provisions are less favorable to those uniformly required of contractors for construction work normally covered by those agreements; nor shall any provision be recognized or applied on Program Work if it may be construed to apply exclusively, or predominantly, to work covered by this Agreement.

C. Any disagreement between signatories to this Agreement over the incorporation into Schedule A of provisions agreed upon in the renegotiation of Area Collective Bargaining Agreements shall be resolved in accordance with the procedure set forth in Article 9 of this Agreement.

SECTION 2. LABOR DISPUTES DURING AREA CONTRACT NEGOTIATIONS

The Unions agree that there will be no strikes, work stoppages, sympathy actions, picketing, slowdowns or other disruptive activity or other violations of Article 7 affecting the Program Work by any Local Union involved in the renegotiation of Area Local Collective Bargaining Agreements nor shall there be any lock-out on such Program Work affecting a Local Union during the course of such renegotiations.

ARTICLE 20 - WORKERS' COMPENSATION ADR

SECTION 1.

An ADR program may be negotiated and participation in the ADR Program will be optional by trade.

ARTICLE 21 - HELMETS TO HARDHATS

SECTION 1.

The Contractors and the Unions recognize a desire to facilitate the entry into the building and construction trades of veterans who are interested in careers in the building and construction industry. The Contractors and Unions agree to utilize the services of the New York City Helmets to Hardhats Program to serve as a resource for preliminary orientation, assessment of construction aptitude, referral to apprenticeship programs or hiring halls, counseling and mentoring, support network, employment opportunities and other needs as identified by the parties.

SECTION 2.

The Unions and Contractors agree to coordinate with the Program to create and maintain an integrated database of veterans interested in working on this Project and of

apprenticeship and employment opportunities for this Project. To the extent permitted by law, the Unions will give credit to such veterans for bona fide, provable past experience.

IN WITNESS WHEREOF the parties have caused this Agreement to be executed and effective as of the ___ day of_____, _____

FOR BUILDING AND CONSTRUCTION TRADES COUNCIL
OF GREATER NEW YORK AND VICINITY

BY: Gary LaBarbera
Gary LaBarbera
President

FOR NEW YORK CITY

BY: _____
Dr. Feniosky Peña-Mora
Commissioner, Department of Design & Construction

APPROVED AS TO FORM:

_____
ACTING CORPORATION COUNSEL
NEW YORK CITY

IN WITNESS WHEREOF the parties have caused this Agreement to be executed and effective as of the ___ day of_____, _____

FOR BUILDING AND CONSTRUCTION TRADES COUNCIL
OF GREATER NEW YORK AND VICINITY

BY: _____
Gary LaBarbera
President

FOR NEW YORK CITY

BY: _____
Dr. Feniosky Peña-Mora
Commissioner, Department of Design & Construction

APPROVED AS TO FORM:

_____
ACTING CORPORATION COUNSEL
NEW YORK CITY

TM

SEP 23 2015

LIST OF SIGNATORY UNIONS
Boiler Makers Local No. 5
Carpenters District Council
Cement Masons No. 780
Concrete Workers, District Council No. 16
Derrickmen and Riggers, Local Union No. 197
Drywall Tapers 1974, District Council 9
Electrical Workers Local No. 3
Glaziers Local Union No. 1087 District Council 9
Heat & Frost Insulators, Local Union No. 12A
Heat & Frost Insulators, Local Union No. 12
Iron Workers District Council
Iron Workers Local Union No. 40
Iron Workers Local No. 361
Laborers Local No. 78, Asbestos & Lead Abatement
Laborers Local 1010 Pavers and Road Builders District Council
Laborers 79 Construction and General Building Laborers
Laborers Local No. 731 Excavators
Mason Tenders District Council
Metal Lathers Local No. 46
Metal Polishers District Council 9
Ornamental Iron Workers Local No. 580
Painters District Council 9
Plumbers Local No. 1
Painters, Decorators & Wallcoverers District Council 9
Painters Structural Steel No. 806
Plasterers Local Union No. 262
Roofers & Waterproofers Local 8
Steamfitters Local Union No. 638
Sheet Metal Workers Local No. 28
Sheet Metal Workers Local No. 137
Teamsters Local Union No. 282
Teamsters Local Union 814
Teamsters Local No. 813 Private Sanitation
Tile, Marble & Terrazzo B.A.C. Local Union No. 7

SCHEDULE "A"

Union	Current Agreement w/
Architectural and Ornamental Iron Workers Local Union 580, AFL-CIO	Allied Building Metal Industries, Inc.
Building, Concrete, Excavating & Common Laborers Local 731	Independent
Building, Concrete, Excavating & Common Laborers Local 731	Members of the General Contractors Association of New York, Inc.
District Council No. 9, I.U.P.A.T Glaziers Local 1087	Window and Plate Glass Dealers Association
Drywall Tapers and Pointers Local 1974, affiliated with International Union of Painters & Allied Trades and Drywall Taping Contractor's Association & Association of Wall-Ceiling & Carpentry Industries NY, Inc.	Independent
Enterprise Association of Steamfitters and Apprentices Local 638	Mechanical Contractors Association of NY, Inc.
Enterprise Association of Steamfitters and Apprentices Local 638	Independent
Highway Road and Street Laborers Local Union 1010 of the District Council of Pavers and Road Builders of the Laborers' International Union of North America AFL-CIO	Independent
Highway Road and Street Laborers Local Union 1010 of the District Council of Pavers and Road Builders of the Laborers' International Union of North America AFL-CIO	Member of the General Contractors Association of New York, Inc.
International Association of Heat and Frost Insulators and Allied Workers Local No. 12 of New York City	Independent
International Association of Heat and Frost Insulators and Allied Workers Local No. 12 of New York City	The Insulation Contractors Association of New York City, Inc.
International Association of Heat and Frost Insulators and Allied Workers Local No. 12A of New York City	Independent

International Association of Heat and Frost Insulators and Allied Workers Local No. 12A of New York City	Environmental Contractors Association, Inc.
International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, AFL-CIO, Local Lodge No. 5	Boilermakers Association of Greater New York
Local Union No. 3 International Brotherhood of Electrical Workers, AFL-CIO	New York Electrical Contractors Association
International Brotherhood of Teamsters, Local 282, High Rise contract	Building Contractors Association & Independents
Local 46 Metallic Lathers Union and Reinforcing Iron Workers of NY and Vicinity of the International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers	Cement League
Local 46 Metallic Lathers Union and Reinforcing Iron Workers of NY and Vicinity of the International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers	Independent
Local 8 Roofers, Waterproofers & Allied Workers	Roofing and Waterproofing Contractors Association of New York and Vicinity
Local Union 1 of the United Association of Journeymen and Apprentices of the Pipe Fitting Industry of the United States and Canada	Association of Contracting Plumbers of the City of New York
Local Union Number 40 & 361 of Bridge, Structural Ornamental and Reinforcing Iron Workers AFL-CIO	Independent
Operative Plasterers' and Cement Masons' International Association Local No. 262	Independent
Painters and Allied Trades AFL-CIO, District Council No. 9 (Painting and Protective Coatings CBA)	Independent

Painters and Allied Trades AFL-CIO, District Council No. 9 (Painting and Protective Coatings CBA)	The Association of Master Painters & Decorators of NY, Inc. and The Association of Wall, Ceiling & Carpentry Industries of NY, Inc. and The Window and Plate Glass Dealers Association
Sheet Metal Workers' International Association, Local 28	Sheet Metal & Air Conditioning Contractors Association of New York City, Inc.
Sheet Metal Workers' International Association, Local 137	The Greater New York Sign Association
Structural Steel and Bridge Painters Local 806, DC 9 International Union of Painters and Allied Trades, AFL-CIO	New York Structural Steel Painting Contractors Association
Teamsters Local 813	Independent
Teamsters Local 813	IESI NY Corporation
Teamsters Local 814	Greater New York Movers and Warehousemen's Bargaining Group
The Cement Masons' Union, Local 780	Cement League
The District Council of Cement and Concrete Workers (comprised of Local 6A; Local 18A and Local 20)	Cement League
The District Council of Cement and Concrete Workers (comprised of Local 6A; Local 18A and Local 20)	Independent

The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Heavy Carpenters	GCA
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Dockbuilders Local No. 1556	Concrete Contractors of NY
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Dockbuilders Local 1556	Independent
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Millwright Local 740	Independent
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Timbermen Local 1556	Independent
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Timbermen Local 1556	GCA
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Heavy Carpenters	Independent
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Carpenters	Manufacturing Woodworkers Association of Greater New York Incorporated
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America	The Hoisting Trade Association of New York, Inc.
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America	The Test Boring Association

The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America	Building Contractors Association
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America	The Association of Wall-Ceiling & Carpentry Industries of New York, Incorporated
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners	The Cement League
The District Council of NYC and Vicinity of the United Brotherhood of Carpenters and Joiners of America	New York City Millwright Association
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners	Greater New York Floor Covering Association
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Carpenters	Association of Architectural Metal & Glass
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Carpenters	Concrete Contractors of NY
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Building Construction Carpenters	Independent
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Local 2287	Independent
The District Council of New York City and Vicinity of the United Brotherhood of Carpenters and Joiners of America for Shop Carpenters	Independent
The Tile Setters and Tile Finishers Union of New York and New Jersey, Local 7 of the International Bricklayers and Allied Craftworkers	The Greater New York and New Jersey Contractors Association

United Derrickmen & Riggers Association, Local 197 of NY, LI, Westchester & Vicinity	Contracting Stonesetters Association Inc.
United Derrickmen & Riggers Association L 197 of NY, LI, Westchester and Vicinity	Building Stone and Pre-cast Contractors Association
International Union of Operating Engineers Local 14-14B	Building Contractors Association
International Union of Operating Engineers Local 14-14B	Contractors Association of Greater NY
International Union of Operating Engineers Local 14-14B	GCA
International Union of Operating Engineers Local 14-14B	The Cement League
International Union of Operating Engineers Local 14-14B	Allied Building Metal Industries, Inc.
International Union of Operating Engineers Local 14-14B	Brick Association
International Union of Operating Engineers Local 14-14B	Independent
International Union of Operating Engineers Local 15	Allied Building Metal Industries, Inc.
International Union of Operating Engineers Local 15-15A	General Contractors Association
International Union of Operating Engineers Local 15D	General Contractors Association
International Union of Operating Engineers Local 15D	Structural Steel Erectors

International Union of Operating Engineers Local 15-15A	Building Contractors Association
International Union of Operating Engineers Local 15D	Building Contractors Association
International Union of Operating Engineers Local 15-15A	Contractors Association of Greater NY
International Union of Operating Engineers Local 15D	Contractors Association of Greater NY
International Union of Operating Engineers Local 15-15A	The Cement League
International Union of Operating Engineers Local 15D	The Cement League

Project Labor Agreement - - Letter of Assent

Dear:

The undersigned party confirms that it agrees to be a party to and be bound by the New York Agency, Project Labor Agreement as such Agreement may, from time to time, be amended by the parties or interpreted pursuant to its terms. The terms of the Project Labor Agreement, its Schedules, Addenda and Exhibits are hereby incorporated by reference herein.

The undersigned, as a Contractor or Subcontractor (hereinafter Contractor) on the Project known as _____ and located at _____ (hereinafter PROJECT), for and in consideration of the award to it of a contract to perform work on said PROJECT, and in further consideration of the mutual promises made in the Project Labor Agreement, a copy of which was received and is acknowledged, hereby:

(1) Accepts and agrees to be bound by the terms and conditions of the Agreement, together with any and all schedules; amendments and supplements now existing or which are later made thereto:

(2) Agrees to be bound by the legally established collective bargaining agreements; local trust agreements for employee benefit funds; and trust documents for joint apprentice programs as well as apprentice program rules and procedures but only to the extent of Program Work and as required by the PLA.

(3) Authorizes the parties to such local trust agreements to appoint trustees and successor trustees to administer the trust funds and hereby ratifies and accepts the trustees so appointed as if made by the Contractor but only to the extent of Program Work as required by the PLA.

(4) Certifies that it has no commitments or agreements that would preclude its full and complete compliance with the terms and conditions of said Agreement. The Contractor agrees to employ labor that can work in harmony with all other labor on the Project and shall require labor harmony from every lower tier subcontractor it has engaged or may engage to work on the Project. Labor harmony disputes/issues shall be subject to the Labor Management Committee provisions.

(5) Agrees to secure from any Contractor(s) (as defined in said Agreement) which is or becomes a Subcontractor (of any tier), to it, a duly executed Agreement to be Bound in from identical to this document.

Provide description of the Work, identify craft jurisdiction(s) and all contract numbers below:

Dated: _____

_____
(Name of Contractor or subcontractor)

_____
(Name of CM; GC; Contractor or Higher Level Subcontractor)

_____
(Authorized Officer & Title)

_____
(Address)

_____
(Phone) (Fax)

Contractor's State License #_____

Sworn to before me this
____ day of _____,

_____
Notary Public

NEW YORK CITY BUILDING AND CONSTRUCTION TRADES COUNCIL STANDARDS OF EXCELLENCE

The purpose of this Standard of Excellence is to reinforce the pride of every construction worker and the commitment to be the most skilled, most productive and safest workforce available to construction employers and users in the City of New York. It is the commitment of every affiliated local union to use our training and skills to produce the highest quality work and to exercise safe and productive work practices.

The rank and file members represented by the affiliated local unions acknowledge and adopt the following standards:

- ***Provide a full days work for a full days pay;***
- ***Safely work towards the timely completion of the job;***
- ***Arrive to work on time and work until the contractual quitting time;***
- ***Adhere to contractual lunch and break times;***
- ***Promote a drug and alcohol free work site;***
- ***Work in accordance with all applicable safety rules and procedures;***
- ***Allow union representatives to handle job site disputes and grievances without resort to slowdowns, or unlawful job disruptions;***
- ***Respect management directives that are safe, reasonable and legitimate;***
- ***Respect the rights of co-workers;***
- ***Respect the property rights of the owner, management and contractors.***

The Unions affiliated with the New York City Building and Construction Trades Council will expect the signatory contractors to safely and efficiently manage their jobs and the unions see this as a corresponding obligation of the contractors under this Standard of Excellence. The affiliated unions will expect the following from its signatory contractors:

- ***Management adherence to the collective bargaining agreements;***
- ***Communication and cooperation with the trade foremen and stewards;***
- ***Efficient, safe and sanitary management of the job site;***
- ***Efficient job scheduling to mitigate and minimize unproductive time;***
- ***Efficient and adequate staffing by properly trained employees by trade;***
- ***Efficient delivery schedules and availability of equipment and tools to ensure efficient job progress;***
- ***Ensure proper blueprints, specifications and layout instructions and material are available in a timely manner***
- ***Promote job site dispute resolution and leadership skills to mitigate such disputes;***
- ***Treatment of all employees in a respectful and dignified manner acknowledging their contributions to a successful project.***

The affiliated unions and their signatory contractors shall ensure that both the rank and file members and the management staff shall be properly trained in the obligations undertaken in the Standard of Excellence.

BUILDSAFENYC

Codes of Conduct

BuildSafeNYC establishes that all BTEA member companies and BCTC member unions establish minimum safety standards on all building construction projects in NYC as follows:

1. The workforce shall adhere to the minimum personal protective equipment (PPE) usage to include:
   a. ANSI compliant Hard Hats (with ratchet suspension) at all times (supplied by employer)
   b. Construction-type Work Boots at all times
   c. Long Pants and shirts with at least short sleeves at all times (no shorts or tank tops)
   d. ANSI compliant Eye Protection in their possession and used as needed (supplied by employer)
   e. Adequate Hearing Protection in their possession and used as needed (supplied by employer)
   f. High-vis traffic vests at street level and when around heavy equipment (supplied by employer)
2. CM and Subcontractor management shall implement a fair and consistent disciplinary policy for all site personnel regarding the adherence to site safety rules and requirements. Likewise, a joint labor / management team will periodically assess project wide implementation of these Codes.
3. CM firms shall maintain minimum standards for workforce restroom, hygiene facilities and housekeeping, initially and throughout the duration of the project.
4. All personnel shall adhere to a strict policy against drug and alcohol possession and use on sites and during hours of work.
5. All personnel shall attend a site safety orientation prior to beginning work. Worker certifications of safety training for specific tasks such as fire watch, flagmen, and safety attendant must be verified.
6. No cell phones, portable media devices, radios or other devices that limit hearing and attention shall be used while working on sites.
7. Ground Fault Circuit Interrupters (GFCI) will be used on all power tools and extension cords.
8. Union trade representatives shall participate in a regularly scheduled site safety meeting on all projects regardless of size.
9. Extreme effort shall be made to isolate the public from all construction activity. Specifically, systems shall be put in place to control falling materials and pedestrian exposure. This should be a top priority for the entire project workforce.
10. Workers shall honor security access control systems to establish entry to sites by authorized personnel only, where applicable.
11. Fall protection management shall be a top project priority. Workers shall maintain and use necessary fall protection systems and procedures where appropriate. Engineering controls and work methods which eliminate, guard, or otherwise control fall hazards shall take priority over personal fall arrest system usage.
12. Where hazardous materials are present, projects shall implement efforts to communicate and control potential exposure to the workforce.

With Full Support and Endorsement of:

Louis J. Coletti, President & CEO
Building Trades Employers Association

BTEANYC The Voice of Construction
Building Trades Employers' Association

Edward J. Malloy, President
Building and Construction Trades Council

Construction Management Firms:

Trade Unions:

CITY OF NEW YORK

DEPARTMENT OF
DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

INFORMATION FOR BIDDERS

December 2013

INFORMATION FOR BIDDERS

1. Description and Location of Work

The description and location of the work for which bids are requested are specified in Attachment 1, "Bid Information". Attachment 1 is included in the Bid Booklet.

2. Time and Place for Receipt of Bids

Sealed bids shall be received on or before the date and hour specified in Attachment 1, at which time they will be publicly opened and read aloud in the presence of the Commissioner or his or her representative, and any bidders who may desire to be present.

3. Definitions

The definitions set forth in the Procurement Policy Board Rules shall apply to this Invitation For Bids.

4. Invitation For Bids and Contract Documents

(A) Except for titles, sub-titles, headings, running headlines, tables of contents and indices (all of which are printed herein merely for convenience) the following, except for such portions thereof as may be specifically excluded, shall be deemed to be part of the Contract and the Invitation for Bids.

(1) All provisions required by law to be inserted in this Contract, whether actually inserted or not
(2) The Contract Drawings and Specifications
(3) The General Conditions, the General Requirements and the Special Conditions, if any
(4) The Contract
(5) The Information for Bidders; Request for Proposals; Notice of Solicitation and Proposal For Bids; Bid or Proposal, and, if used, the Bid Booklet
(6) The Budget Director's Certificate; all Addenda issued prior to the receipt of the bids; the Notice of Award; Performance and Payment Bonds, if required; and the Notice to Proceed with the Work.

(B) For particulars as to this procurement, including quantity and quality of the purchase, extent of the work or labor to be performed, delivery and performance schedule, and any other special instructions, prospective bidders are referred to the Invitation For Bids Documents. A copy of such documents can be obtained at the location set forth in Attachment 1.

(C) Deposit for Copy of Invitation For Bids Documents: Prospective bidders may obtain a copy of the Invitation For Bids Documents by complying with the conditions set forth in the Notice of Solicitation. The deposit must be in the form of a check or money order made payable to the City of New York, and drawn upon a state or national bank or trust company, or a check of such bank or trust company signed by a duly authorized officer thereof.

(D) Return of Invitation For Bids Documents: All Invitation For Bids Documents must be returned to the Department upon request. If the bidder elects not to submit a bid thereunder, the Invitation For Bids Documents shall be returned to the Department, along with a statement that no bid will be submitted.

(E) Return of Deposit: Such deposit will be returned within 30 days after the award of the contract or the rejection of all bids as set forth in the advertisement, provided the Invitation For Bids Documents are returned to the location specified in Attachment 1, in physical condition satisfactory to the Commissioner.

(F) Additional Copies: Additional copies of the Invitation For Bids Documents may be obtained, subject to the conditions set forth in the advertisement for bids.

5. Pre-Bid Conference

A pre-bid conference shall be held as set forth in Attachment 1. Nothing stated at the pre-bid conference shall change the terms or conditions of the Invitation For Bids Documents, unless a change is made by written amendment as provided in Section 9 below. Failure to attend a mandatory pre-bid conference shall constitute grounds for the rejection of the bid.

6. Agency Contact

Any questions or correspondence relating to this bid solicitation shall be addressed to the Agency Contact person specified in Attachment 1.

7. Bidder's Oath

(A) The bid shall be properly signed by an authorized representative of the bidder and the bid shall be verified by the written oath of the authorized representative who signed the bid, that the several matters stated and information furnished therein are in all aspects true.

(B) A materially false statement willfully or fraudulently made in connection with the bid or any of the forms completed and submitted with the bid may result in the termination of any Contract between the City and the Bidder. As a result, the Bidder may be barred from participating in future City contracts as well as be subject to possible criminal prosecution.

8. Examination and Viewing of Site, Consideration of Other Sources of Information and Changed Conditions

(A) Pre-Bidding (Investigation) Viewing of Site - Bidders must carefully view and examine the site of the proposed work, as well as its adjacent area, and seek other usual sources of information, for they will be conclusively presumed to have full knowledge of any and all conditions on, about or above the site relating to or affecting in any way the performance of the work to be done under the Contract which were or should have been indicated to a reasonably prudent bidder. To arrange a date for visiting the work site, bidders are to contact the Agency Contact person specified in Attachment 1.

(B) Should the contractor encounter during the progress of the work subsurface conditions at the site materially differing from any shown on the Contract Drawings or indicated in the Specifications or such subsurface conditions as could not reasonably have been anticipated by the contractor and were not anticipated by the City, which conditions will materially affect the cost of the work to be done under the Contract, the attention of the Commissioner must be called immediately to such conditions before they are disturbed. The Commissioner shall thereupon promptly investigate the conditions. If he finds that they do so materially differ, or that they could not reasonably have been anticipated by the contractor and were not anticipated by the City, the Contract may be modified with his written approval.

9. Examination of Proposed Contract

(A) Request for Interpretation or Correction: Prospective bidders must examine the Contract Documents carefully and before bidding must request the Commissioner in writing for an interpretation or correction of every patent ambiguity, inconsistency or error therein which should have been discovered by a reasonably prudent bidder. Such interpretation or correction, as well as any additional contract provisions the Commissioner may decide to include, will be issued in writing by the Commissioner as an addendum to the Contract, which will be transmitted to each person recorded as having received a copy of the Contract Documents from the Department. Transmission of such addendum will be by mail, e-mail, facsimile or hand delivery. Such addendum will also be posted at the place where the Contract Documents are available for the inspection of prospective bidders. Upon transmission as provided for herein, such addendum shall become a part of the Contract Documents, and binding on all bidders, whether or not actual notice of such addendum is shown.

(B) Only Commissioner's Interpretation or Correction Binding: Only the written interpretation or correction so given by the Commissioner shall be binding, and prospective bidders are warned that no other officer, agent or employee of the City is authorized to give information concerning, or to explain or interpret, the Contract.

(C) Documents given to a subcontractor for the purpose of soliciting the subcontractor's bid shall include either a copy of the bid cover sheet or a separate information sheet setting forth the project name, the Contract number (if available), the contracting agency and the Project's location.

10. Form of Bid

Each bid must be submitted upon the prescribed form and must contain: a) the name, residence and place of business of the person or persons making the same; b) the names of all persons interested therein, and if no other person is so interested, such fact must be distinctly stated; c) a statement to the effect that it is made without any connection with any other person making a bid for the same purpose and that it is in all respects fair and without collusion or fraud; d) a statement that no Council member or other officer or employee or person whose salary is payable in whole or part from the City Treasury is directly or indirectly interested therein or in the supplies, materials or equipment and work or labor to which it relates, or in any portion of the profits thereof; e) a statement that the bidder is not in arrears to the City or to any agency upon a debt or contract or taxes, and is not a defaulter as surety or otherwise upon any obligation to the City to any agency thereof, except as set forth in the bid.

THE BID SHALL BE TYPEWRITTEN OR WRITTEN LEGIBLY IN INK. THE BID SHALL BE SIGNED IN INK. ERASURES OR ALTERATIONS SHALL BE INITIALED BY THE SIGNER IN INK. FAILURE TO CONFORM TO THE REQUIREMENTS OF THIS SECTION 10 SHALL RESULT IN THE REJECTION OF THE BID.

11. Irrevocability of Bid

The prices set forth in the bid cannot be revoked and shall be effective until the award of the Contract, unless the bid is withdrawn as provided for in Sections 15 and 18 below.

12. Acknowledgment of Amendments

The receipt of any amendment to the Contract Documents shall be acknowledged by the bidder in its bid submission.

13. Bid Samples and Descriptive Literature

Bid samples and descriptive literature shall not be submitted by the bidder, unless expressly requested elsewhere in the Contract or Contract Documents. Any unsolicited bid samples or descriptive literature which are submitted shall not be examined or tested and shall not be deemed to vary any of the provisions of this Contract.

14. Proprietary Information/Trade Secrets

(A) The bidder shall identify those portions of the bid which it deems to be confidential, proprietary information or trade secrets, and provide justification why such materials shall not be disclosed by the City. All such materials shall be clearly indicated by stamping the pages on which such information appears, at the top and bottom thereof with the word "Confidential". Such materials stamped "Confidential" must be easily separable from the non-confidential sections of the bid.

(B) All such materials so indicated shall be reviewed by the Agency and any decision not to honor a request for confidentiality shall be communicated in writing to the bidder. For those bids which are unsuccessful, all such confidential materials shall be returned to the bidder. Prices, makes and model or catalog numbers of the items offered, deliveries, and terms of payment shall be publicly available after bid opening, regardless of any designation of confidentiality made by the bidder.

15. Pre-Opening Modification or Withdrawal of Bids

Bids may be modified or withdrawn by written notice received in the office designated in Attachment 1, before the time and date set for the bid opening. If a bid is withdrawn in accordance with this Section, the bid security, if any, shall be returned to the bidder.

16. Bid Evaluation and Award

In accordance with the New York City Charter, the Procurement Policy Board Rules and the terms and conditions of this Invitation For Bids, this Contract shall be awarded, if at all, to the responsible bidder whose bid meets the requirements and evaluation criteria set forth in the Invitation For Bids, and whose bid price is either the most favorable bid price or, if the Invitation For Bids so states, the most favorable evaluated bid price. A bid may not be evaluated for any requirement or criterion that is not disclosed in the Invitation For Bids.

Restriction: No negotiations with any bidder shall be allowed to take place except under the circumstances and in the manner set forth in Section 21. Nothing in this Section shall be deemed to permit a contract award to a bidder submitting a higher quality item than that designated in the Invitation For Bids, if that bid is not also the most favorable bid.

17. Late Bids, Late Withdrawals and Late Modifications

Any bid received at the place designated in the solicitation after the time and date set for receipt of bids is late and shall not be considered. Any request for withdrawal or modification received at the place designated in the solicitation after the time and date set for receipt of bids is late and shall not be considered. The exception to this provision is that a late modification of a successful bid that makes the bid terms more favorable to the City shall be considered at any time it is received.

18. Withdrawal of Bids.

Except as provided for in Section 15, above, a bidder may not withdraw its bid before the expiration of forty-five (45) days after the date of the opening of bids; thereafter, a bidder may withdraw its bid only in writing and in advance of an actual award. If within sixty (60) days after the execution of the Contract, the Commissioner fails to fix the date for commencement of work by written notice to the bidder, the bidder, at his option, may ask to be relieved of his obligation to perform the work called for by written notice to the Commissioner. If such notice is given to the Commissioner, and the request to withdraw is granted, the bidder waives all claims in connection with this Contract.

19. Mistake in Bids

(A) Mistake Discovered Before Bid Opening: A bidder may correct mistakes discovered before the time and date set for bid opening by withdrawing or correcting the bid as provided in Section 15 above.

(B) Mistakes Discovered Before Award

(1) In accordance with General Municipal Law (Section 103, subdivision 11), where a unilateral error or mistake is discovered in a bid, such bid may be withdrawn upon written approval of the Agency Chief Contracting Officer if the following conditions are met:

(a) The mistake is known or made known to the agency prior to the awarding of the Contract or within 3 days after the opening of the bid, whichever period is shorter; and

(b) The price bid was based upon an error of such magnitude that enforcement would be unconscionable; and

(c) The bid was submitted in good faith and the bidder submits credible evidence that the mistake was a clerical error as opposed to a judgment error; and

(d) The error in the bid is actually due to an unintentional and substantial arithmetic error or an unintentional omission of a substantial quantity of work, labor, material or services made directly in the compilation of the bid, which unintentional arithmetic error pr unintentional omission can be clearly shown by objective evidence drawn from inspection of the original work paper, documents, or materials used in the preparation of the bid sought to be withdrawn; and

(e) It is possible to place the agency in the same position as existed prior to the bid.

(2) Unless otherwise required by law, the sole remedy for a bid mistake in accordance with this Article shall be withdrawal of the bid, and the return of the bid bond or other security, if any, to the bidder. Thereafter, the agency may, in its discretion, award the Contract to the next lowest bidder or rebid the Contract. Any amendment to or reformation of a bid or a Contract to rectify such an error or mistake therein is strictly prohibited.

(3) If the mistake and the intended correct bid are clearly evident on the face of the bid document, the bid shall be corrected to the intended correct bid and may not be withdrawn. Examples of mistakes that may be corrected are typographical errors, errors in extending unit prices, transposition errors and arithmetical errors.

20. Low Tie Bids

(A) When two or more low responsive bids from responsible bidders are identical in price, meeting all the requirements and criteria set forth in the Invitation For Bids, the Agency Chief Contracting Officer will break the tie in the following manner and order of priority:

(1) Award to a certified New York City small, minority or woman-owned business entity bidder;
(2) Award to a New York City bidder;
(3) Award to a certified New York State small, minority or woman-owned business bidder;
(4) Award to a New York State bidder.

(B) If two or more bidders still remain equally eligible after application of paragraph (A) above, award shall be made by a drawing by lot limited to those bidders. The bidders involved shall be invited to attend the drawing. A witness shall be present to verify the drawing and shall certify the results on the bid tabulation sheet.

21. Rejection of Bids

(A) Rejection of Individual Bids: The Agency may reject a bid if:

(1) The bidder fails to furnish any of the information required pursuant to Section 24 or 28 hereof; or if
(2) The bidder is determined to be not responsible pursuant to the Procurement Policy Board Rules; or if
(3) The bid is determined to be non-responsive pursuant to the Procurement Policy Board Rules; or if
(4) The bid, in the opinion of the Agency Chief Contracting Officer, contains unbalanced bid prices and is thus non-responsive, unless the bidder can show that the prices are not unbalanced for the probable required quantity of items, or if the imbalance is corrected pursuant to Section 15.

(B) Rejection of All Bids: The Agency, upon written approval by the Agency Chief Contracting Officer, may reject all bids and may elect to resolicit bids if in its sole opinion it shall deem it in the best interest of the City so to do.

(C) Rejection of All Bids and Negotiation With All Responsible Bidders: The Agency Head may determine that it is appropriate to cancel the Invitation For Bids after bid opening and before award and to complete the acquisition by negotiation. This determination shall be based on one of the following reasons:

(1) All otherwise acceptable bids received are at unreasonable prices, or only one bid is received and the Agency Chief Contracting Officer cannot determine the reasonableness of the bid price, or no responsive bid has been received from a responsible bidder; or

(2) In the judgment of the Agency Chief Contracting Officer, the bids were not independently arrived at in open competition, were collusive, or were submitted in bad faith.

(D) When the Agency has determined that the Invitation for Bids is to be canceled and that use of negotiation is appropriate to complete the acquisition, the contracting officer may negotiate and award the Contract without issuing a new solicitation, subject to the following conditions:

(1) prior notice of the intention to negotiate and a reasonable opportunity to negotiate have been given by the contracting officer to each responsible bidder that submitted a bid in response to the Invitation for Bids;

(2) the negotiated price is the lowest negotiated price offered by a responsible bidder; and

(3) the negotiated price is lower than the lowest rejected bid price of a responsible bidder that submitted a bid in response to the Invitation for Bids.

22. Right to Appeal Determinations of Non-Responsiveness or Non-Responsibility and Right to Protest Solicitations and Award

The bidder has the right to appeal a determination of non-responsiveness or non-responsibility and has the right to protest a solicitation and award. For further information concerning these rights, the bidder is directed to the Procurement Policy Board Rules.

23. Affirmative Action and Equal Employment Opportunity

This Invitation For Bids is subject to applicable provisions of Federal, State and Local Laws and executive orders requiring affirmative action and equal employment opportunity.

24. VENDEX Questionnaires

(A) Requirement: Pursuant to Administrative Code Section 6-116.2 and the PPB Rules, bidders may be obligated to complete and submit VENDEX Questionnaires. Generally, if this bid is $100,000 or more, or if this bid when added to the sum total of all contracts, concessions and franchises the bidder has received from the City and any subcontracts received from City contractors over the past twelve months, equals or exceeds $100,000, Vendex Questionnaires must be completed. If required, Vendex Questionnaires must be completed and submitted before any award of contract may be made or before approval is given for a proposed subcontractor. Non-compliance with these submission requirements may result in the disqualification of the bid, disapproval of a subcontractor, subsequent withdrawal of approval for the use of an approved subcontractor, or the cancellation of the contract after its award.

(B) Submission: Vendex Questionnaires must be submitted directly to the Mayor's Office of Contract Services, ATTN: Vendex, 253 Broadway, 9th Floor, New York, New York 10007. In addition, the bidder must submit a Confirmation of Vendex Compliance to the agency. A form for this confirmation is set forth in the Bid Booklet.

(C) Obtaining Forms: Vendex Questionnaires, as well as detailed instructions, may be obtained at www.nyc.gov/vendex. The bidder may also obtain Vendex forms and instructions by contacting the Agency Chief Contracting Officer or the contact person for this contract.

25. Complaints About the Bid Process

The New York City Comptroller is charged with the audit of contracts in New York City. Any vendor who believes that there has been unfairness, favoritism or impropriety in the bid process should inform the Comptroller, Office of Contract Administration, One Centre Street, Room 835, New York, New York; telephone number (212)669-2797.

26. Bid, Performance and Payment Security

(A) Bid Security: Each bid must be accompanied by bid security in an amount and type specified in Attachment 1. The bid security shall assure the City of New York of the adherence of the bidder to its proposal, the execution of the Contract, and the furnishing of Performance and Payment Bonds by the bidder, if required in Attachment 1. Bid security shall be returned to the bidder as follows:

(1) Within ten (10) days after the bid opening, the Comptroller will be notified to return the deposits of all but the three (3) lowest bidders. Within five (5) days after the award, the Comptroller will be notified to return the deposits of the remaining two unsuccessful bidders.
(2) Within five (5) days after the execution of the Contract and acceptance of the Contractor's bonds, the Comptroller will be notified to return the bid security of the successful bidder or, if performance and payment bonds are not required, only after the sum retained under Article 21 of the Contract equals the amount of the bid security.
(3) Where all bids are rejected, the Comptroller will be notified to return the deposit of the three (3) lowest bidders at the time of rejection.

(B) Performance and Payment Security: Performance and Payment Security must be provided in an amount and type specified in Attachment 1. The performance and payment security shall be delivered by the contractor prior to or at the time of execution of the Contract. If a contractor fails to deliver the required performance and payment security, its bid security shall be enforced, and an award of Contract may be made to the next lowest responsible and responsive bidder, or the contract may be rebid.

(C) Acceptable Types of Security: Acceptable types of security for bids, performance, and payment shall be limited to the following:

(1) a one-time bond in a form satisfactory to the City;
(2) a bank certified check or money order;
(3) obligations of the City of New York; or
(4) other financial instruments as determined by the Office of Construction in consultation with the Comptroller.

Whenever the successful bidder deposits obligations of the City of New York as performance and payment security, the Comptroller may sell and use the proceeds thereof for any purpose for which the principal or surety on such bond would be liable under the terms of the Contract. If the money is deposited with the Comptroller, the successful bidder shall not be entitled to receive interest on such money from the City.

(D) Form of Bonds: Security provided in the form of bonds must be prepared on the form of bonds authorized by the City of New York. Forms for bid, performance, and payment bonds are included in the Invitation for Bids Documents. Such bonds must have as surety thereunder such surety company or companies as are: (1) approved by the City of New York; (2) authorized to do business in the State of New York, and (3) approved by the Department of the Treasury of the United States. Premiums for any required bonds must be included in the base bid.

The bidder is advised that submission of a bid bond where the surety on such bond fails to meet the criteria set forth herein, shall result in the rejection of the bid as non-responsive.

The Department of the Treasury of the United States advises that information concerning approved surety companies may be obtained as follows: (1) from the Government Printing Office at 202-512-1800; (2) through the Internet at http://www.fms.treas.gov/c570/index.html, and (3) through a computerized public bulletin board, which can be accessed by using your computer modem and dialing 202-874-6887.

(E) Power of Attorney: Attorneys in fact who sign bid, performance, or payment bonds must file with each bond a certified copy of their power of attorney to sign said bonds.

27. Failure to Execute Contract

In the event of failure of the successful bidder to execute the Contract and furnish the required security within ten (10) days after notice of the award of the Contract, the deposit of the successful bidder or so much thereof as shall be applicable to the amount of the award made shall be retained by the City, and the successful bidder shall be liable for and hereby agrees to pay on demand the difference between the price bid and the price for which such Contract shall be subsequently awarded, including the cost of any required reletting and less the amount of such deposit. No plea of mistake in such accepted bid shall be available to the bidder for the recovery of the deposit or as a defense to any action based upon such accepted bid. Further, should the bidder's failure to comply with this Section cause any funding agency, body or group (Federal, State, City, Public, Private, etc.) to terminate, cancel or reduce the funding on this project, the bidder in such event shall be liable also to the City for the amount of actual funding withdrawn by such agency on this project, less the amount of the forfeited deposit.

28. Bidder Responsibilities and Qualifications

(A) Bidders must include with their bids all information necessary for a determination of bidder responsibility, as set forth in the Specifications.

(B) The Agency may require any bidder or prospective bidder to furnish all books of account, records, vouchers, statements or other information concerning the bidder's financial status for examination as may be required by the Agency to ascertain the bidder's responsibility and capability to perform the Contract. If required, a bidder must also submit a sworn statement setting forth such information as the Agency may require concerning present and proposed plant and equipment, the personnel and qualifications of his working organizations, prior experience and performance record.

(C) Oral Examination on Qualifications: In addition thereto, and when directed by the Agency, the bidder, or a responsible officer, agent or employee of the bidder, must submit to an oral examination to be conducted by the Agency in relation to his proposed tentative plan and schedule of operations, and such other matters as the Agency may deem necessary in order to determine the bidder's ability and responsibility to perform the work in accordance with the Contract. Each person so examined must sign and verify a stenographic transcript of such examination noting thereon such corrections as such person may desire to make.

(D) If the bidder fails or refuses to supply any of the documents or information set forth in paragraph (B) hereof or fails to comply with any of the requirements thereof, the Agency may reject the bid.

29. Employment Report

In accordance with Executive Order No. 50 (1980) as modified by Executive Order 108 (1986), the filing of a completed Employment Report (ER) is a requirement of doing business with the City of New York for construction contractors with contracts of $1,000,000 or more and subcontractors with construction subcontracts of $750,000 or more. The required forms and information are included in the Bid Booklet.

30. Labor Law Requirements

(A) General: The successful bidder will be required to comply strictly with all Federal, State and local labor laws and regulations.

(B) New York State Labor Law: This Contract is subject to New York State Labor Law Section 220, which requires that construction workers on the site be paid prevailing wages and supplements. The Contractor is reminded that all wage provisions of this Contract will be enforced strictly and failure to comply will be considered when evaluating performance. Noncompliance may result in the contractor being debarred by the City from future contracts. Complaints filed with the Comptroller may result in decisions which may debar a contractor from bidding contracts with any state governmental entity and other political subdivisions.

(C) Records: The Contractor is expected to submit accurate payroll reports and other required documents and verify attendance and job classifications being utilized in compliance with the law, Contract provisions and agency procedures.

31. Insurance

(A) Bidders are advised that the insurance requirements contained herein are regarded as material terms of the Contract. As required by Article 22 of the Contract, the contractor must effect and maintain with companies licensed and authorized to do business in the State of New York, the types of insurance set forth therein, when required by and in the amounts set forth in Schedule A of the General Conditions. Such required insurance must be provided from the date the contractor is ordered to commence work and up to the date of final acceptance of all required work.

(B) The contractor must, within ten days of receipt of the notice of award, submit the following insurance documentation: (a) original certificate of insurance for general liability in the amount required by Schedule A of the General Conditions, and (b) original certificates of insurance or other proof of coverage for workers' compensation and disability benefits, as required by Section 57 of the New York State Workers' Compensation Law and Section 220 of the Disability Benefits Law.

32. Lump Sum Contracts

(A) Comparison of Bids: Bids on Lump Sum Contracts will be compared on the basis of the lump sum price bid, adjusted for alternate prices bid, if any.

(B) Lump Sum Bids for "General Construction Work" which include excavation shall include all necessary excavation work defined in the Specifications as being included in the lump sum bid. The bidder shall also bid a unit price for the additional cost of excavating material which is defined in the Specifications as excavation for which additional payment will be made. The total estimated additional cost of removing such material will be taken as the quantity set forth in the Engineer's Estimate multiplied by the unit price bid. This total estimated cost of additional excavation shall be added to the lump sum bid for the General Construction Work for the purpose of comparing bids to determine the low bidder.

(C) Variations from Engineer's Estimate: The Engineer's Estimate of the quantity of excavation for which additional payment will be made is approximate only and is given solely to be used as a uniform basis for the comparison of bids and such estimate is not to be considered as part of this contract. The quantities actually required to complete the contract work may be more or less than the quantities in the Engineer's Estimate and, if so, no action for damages or for loss of profits shall accrue to the contractor by reason thereof.

33. Unit Price Contracts

(A) Comparison of Bids: Bids on Unit Price Contracts will be compared on the basis of a total estimated price, arrived at by taking the sum of the estimated quantities of such items, in accordance with the Engineer's Estimate of Quantities set forth in the Bid Form, multiplied by the corresponding unit prices, and including any lump sum bids on individual items.

(B) Variations from Engineer's Estimate: Bidders are warned that the Engineer's Estimate of Quantities on the various items of work and materials is approximate only, given solely to be used as a uniform basis for the comparison of bids, and is not be considered part of this contract. The quantities actually required to complete the contract work may be less or more than so estimated, and if so, no action for damages or for loss of profits shall accrue to the contractor by reason thereof.

(C) Overruns: The terms and conditions applicable to overruns of unit price items are set forth in Article 26 of the Contract.

34. Excise Tax

Bidders are referred to the Specifications for information on Federal Excise Tax exemptions.

35. Licenses and Permits

The successful bidder will be required to obtain all necessary licenses and permits necessary to perform the work.

36. Multiple Prime Contractors

If more than one prime contractor will be involved on this project, all contractors are required to examine the Invitation for Bid packages for all other parts of the project.

37. Locally Based Enterprise Requirements (LBE)

This Contract is subject to the requirements of Administrative Code, Section 6-108.1, and the regulations promulgated thereunder. No construction contract will be awarded unless and until these requirements have been complied with in their entirety. The bidder is advised of the provisions set forth below, as well as the provisions with respect to the Locally Based Enterprise Program contained in Article 67 of the Contract. The contractor is advised that:

(A) If any portion of the Contract is subcontracted, not less than ten percent of the total dollar amount of the contract shall be awarded to locally based enterprises ("LBEs"); except, where less than ten percent of the total dollar amount of the Contract is subcontracted, such lesser percentage shall be so awarded.

(B) No contractor shall require performance and payment bonds from LBE subcontractors.

(C) No Contract shall be awarded unless the contractor first identifies in its bid:

(1) the percentage, dollar amount and type of work to be subcontracted; and
(2) the percentage, dollar amount and type of work to be subcontracted to LBEs.

(D) Within ten calendar days after notification of low bid, the apparent low bidder shall submit an "LBE Participation Schedule" to the contracting agency. If such schedule does not identify sufficient LBE subcontractors to meet the requirements of Administrative Code Section 6-108.1, the apparent low bidder shall submit documentation of its good faith efforts to meet such requirements.

(1) The "LBE Participation Schedule" shall include:

(a) the name and address of each LBE that will be given a subcontract,
(b) the percentage, dollar amount and type of work to be subcontracted to the LBE, and
(c) the dates when the LBE subcontract work will commence and end.

(2) The following documents shall be attached to the "LBE Participation Schedule":

(a) verification letters from each subcontractor listed in the "LBE Participation Schedule" stating that the LBE will enter into a formal agreement for work,
(b) certification documents of any proposed LBE subcontractor which is not on the LBE certified list, and
(c) copies of the certification letter of any proposed subcontractor which is an LBE.

(3) Documentation of good faith efforts to achieve the required LBE percentage shall include as appropriate but not limited to the following:

(a) attendance at prebid meetings, when scheduled by the agency, to advise bidders of contract requirements;
(b) advertisement where appropriate in general circulation media, trade association publications and small business media of the specific subcontracts that would be at least equal to the percentage goal for LBE utilization specified by the contractor;
(c) written notification to association of small, minority and women contractors soliciting specific subcontractors;
(d) written notification by certified mail to LBE firms that their interest in the contract is solicited for specific work items and their estimated values;
(e) demonstration of efforts made to select portions of the work for performance by LBE firms in order to increase the likelihood of achieving the stated goal;
(f) documented efforts to negotiate with LBE firms for specific subcontracts, including at a minimum:
(i) The names, address and telephone numbers of LBE firms that are contacted;
(ii) A description of the information provided to LBE firms regarding the plans and specifications for portions of the work to be performed;
(iii) Documentation showing that no reasonable price can be obtained from LBE firms;
(iv) A statement of why agreements with LBE firms were not reached;
(g) a statement of the reason for rejecting any LBE firm which the contractor deemed to be unqualified; and
(h) documentation of efforts made to assist the LBE firms contacted that needed assistance in obtaining required insurance.

(E) Unless otherwise waived by the Commissioner with the approval of the Office of Economic and Financial Opportunity, failure of a proposed contractor to provide the information required by paragraphs (C) and (D) above may render the bid non-responsive and the Contract may not be awarded to the bidder. If the contractor states that it will subcontract a specific portion of the work, but can demonstrate despite good faith efforts it cannot achieve its required LBE percentage for subcontracted work until after award of Contract, the Contract may be awarded, subject to a letter of compliance from the contractor stating that it will comply with Administrative Code Section 6-108.1 and subject to approval by the Commissioner. If the contractor has not met its required LBE percentage prior to award, the contractor shall demonstrate that a good faith effort has been made subsequent to award to obtain LBEs on each subcontract until its meets the required percentage.

(F) When a bidder indicates prior to award that no work will be subcontracted, no work may be subcontracted without the prior written approval of the Commissioner, which shall be granted only if the contractor in good faith seeks LBE subcontractors at least six weeks prior to the start of work.

(G) The contractor may not substitute or change any LBE which was identified prior to award of the contract without the written permission of the Commissioner. The contractor shall make a written application to the Commissioner for permission to make such substitution or change, explaining why the contractor needs to change its LBE subcontractor and how the contractor will meet its LBE subcontracting requirement. Copies of such application must be served on the originally identified LBE by certified mail return receipt requested, as well as the proposed substitute LBE. The Commissioner shall determine whether or not to grant the contractor's request for substitution.

38. Bid Submission Requirements

The Bid Submission Requirements are set forth on page 2 of the Bid Booklet.

39. Comptroller's Certificate

This Contract shall not be binding or of any force unless it is registered by the Comptroller in accordance with Section 328 of the City Charter and the Procurement Policy Board Rules. This Contract shall continue in force only after annual appropriation of funds by the City of New York and certification as hereinabove set forth.

40. Procurement Policy Board Rules

This Invitation For Bids is subject to the Rules of the Procurement Policy Board of the City of New York. In the event of a conflict between said Rules and a provision of this Invitation For Bids, the Rules shall take precedence.

41. DDC Safety Requirements

The DDC Safety Requirements apply to the work to be performed pursuant to the Contract. The DDC Safety Requirements are set forth on the following pages.

CITY OF NEW YORK

DEPARTMENT OF DESIGN AND CONSTRUCTION

SAFETY REQUIREMENTS

June 2015

THE DDC SAFETY REQUIREMENTS INCLUDE THE FOLLOWING SECTIONS:

I. POLICY ON SITE SAFETY

II. PURPOSE

III. DEFINITIONS

IV. RESPONSIBILITIES

V. SAFETY QUESTIONNAIRE

VI. SAFETY PROGRAM AND SITE SAFETY PLAN

VII. KICK-OFF/PRE-CONSTRUCTION MEETINGS AND SAFETY REVIEW

VIII. EVALUATION DURING WORK IN PROGRESS

IX. SAFETY PERFORMANCE EVALUATION

I. POLICY ON SITE SAFETY

The City of New York Department of Design and Construction (DDC) is committed to a policy of injury and illness prevention and risk management for construction work that will ensure the safety and health of the workers engaged in the projects and the protection of the general public. Therefore, it is DDC's policy that work carried out by Contractors on DDC jobsites must, at a minimum, comply with applicable federal, state and city laws, rules and regulations, including without limitation:

- U. S. Department of Labor 29 Code of Federal Regulations (CFR) Part 1926 and applicable Sub-parts of Part 1910 – U.S. Occupational Safety and Health Administration (OSHA); New York State Department of Labor Industrial Code Rule 23 – Protection in Construction, Demolition and Excavation;
- New York City Construction Codes, Title 28
- NYC Department of Transportation Title 34 Chapter 2 – Highway Rules
- New York State Department of Labor Industrial Code Rule 16 NYCRR Part 753
- Title 15 of the Rules of the City of New York, Chapter 13 Citywide Construction Dust Mitigation
- Manual on Uniform Traffic Control Devices (MUTCD)
- Title 15 of the Rules of the City of New York, Chapter 28 Citywide Construction Noise Mitigation

II. PURPOSE

The purpose of this policy is to ensure that Contractors perform their work and supervise their employees in accordance with all applicable federal, state and city rules and regulations. Further, Contractors will be expected to minimize or eliminate jobsite and public hazard, through a planning, inspection, auditing and corrective action process. The goal is to control risks so that injuries, illnesses and accidents to contractors' employees, DDC employees and the general public, as well as damage to city-owned and private property, are reduced to the lowest level feasible.

III. DEFINITIONS

Agency Chief Contracting Officer (ACCO): The ACCO shall mean the person delegated authority by the Commissioner to organize and supervise the procurement activity of subordinate Agency staff in conjunction with the CCPO.

Competent Person: As defined by OSHA, an individual who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees or the general public, and who has authorization to take prompt corrective measures to eliminate them.

Construction Safety Auditor: A representative of the QA&CS Construction Safety Unit who provides inspection and assessment services to enhance health and safety on all DDC construction projects. The activities of the Construction Safety Auditor include performing site surveys, reviewing health and safety plans, reviewing construction permits, and rendering technical advice and assistance to DDC Resident Engineers and Project Managers.

Construction Safety Unit: A part of QA&CS within the Division of Program Management/ Safety & Site Support that assesses contractor safety on DDC jobsites and advises responsible parties of needed corrective actions.

Construction Superintendent: A representative of the contractor responsible for overseeing performance of the required construction work. This individual must engage in sound construction practices, and is responsible to maintain a safe work site. In the case of a project involving the demolition, alteration or new construction of buildings, the Construction Superintendent must be licensed by the NYC Department of Buildings.

Contractor: For purposes of these Safety Requirements, the term "Contractor" shall mean any person or entity that enters into a contract for the performance of construction work on a DDC project. The term "Contractor" shall include any person or entity which enters into any of the following types of contracts: (1) a prime construction contract for a specific project, (2) a prime construction contract using the Job Order Contracting System ("JOCS Contract"), and (3) a subcontract with a CM/Builder ("First Tier Subcontract").

Daily Safety Job Briefing: Daily jobsite safety meetings, giving to all jobsite personnel by contractor, with the purpose of discussing project specific safety procedures for the scheduled construction work.

Director - Quality Assurance and Construction Safety (QA&CS): Responsible for the operations of the QACS Construction Safety Unit and the DDC Site Safety management programs.

Job Hazard Analysis (JHA): A process of identifying the major job steps and any potential site-specific hazards that may be present during construction and establishing the means and methods to eliminate or control those hazards.

Qualified Person: As defined by OSHA, an individual who, by possession of a recognized degree, certificate, license or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his or her ability to solve problems relating to the subject matter, the work, or the project. Qualified Persons are required under regulation to address issues pertaining, but without limit, to fall protection, scaffold design and trenching and shoring, among others.

Project Site: Those areas indicated in the Contract Documents where the Work is to be performed.

Project Safety Representative: The designated project safety representative shall have completed an authorized 30 hour OSHA Construction Safety Course and other safety training applicable to Contractor's/subcontractor's project work. Except in instances where a dedicated Project Safety Manager is required, a Project Safety Representative may also function as a superintendent, foreman or crew leader on the Project, but must have sufficient experience and authority to undertake corrective actions and must qualify to be a competent person. No work is to be performed on site when a Project Safety Representative is not present.

Project Safety Manager: A dedicated, full-time project safety manager may be a contractual requirement on large projects or projects deemed by DDC to be particularly high risk. This would be in addition or in lieu of a Contractor's Project Safety Representative. This individual shall not have any other assigned duties. This individual shall have received, at a minimum an authorized 30 hour OSHA Construction Safety Course. Other examples of acceptable training are OSHA Safety and Health Standards for the Construction Industry training program (OSHA 510), Certified Safety Professional (CSP), Certified Industrial Hygienist (CIH) or a degree/certificate in a safety and health from a college-level curriculum.
A Project Safety Manager shall possess the additional training, years of experience, and skills necessary to thoroughly understand the health and safety hazards and controls for large construction projects, including the full scope of the specific Work.

QA&CS – Quality Assurance and Construction Safety of the New York City Department of Design and Construction.

Resident Engineer (RE) / Construction Project Manager (CPM): Representative of the Commissioner duly designated by the Commissioner to be his/her representative at the site of the work. (The RE/CPM may be a third-party consultant, including a Construction Management firm, retained by DDC)

Safety Program: Established by the Contractor that covers all operations of that Contractor and establishes the Contractor's overall safety policy, regulatory compliance plan and minimum safety standards. The Safety Program must be submitted prior to the commencement of work at the site and is subject to review and acceptance by the Construction Safety Unit.

Safety Questionnaire: Used by DDC to evaluate Contractor's current and past safety performance. It is required to be completed by all Contractors initially when submitting bids for Construction work, or when being pre-qualified and updated annually or as requested by the DDC.

Site Safety Manager: For certain projects, as defined in NYC Construction Codes – Title 28, the Contractor shall provide a Site Safety Manager with a Site Safety Manager License issued by the NYC Department of Building.

Site Safety Plan: A site-specific safety plan developed by the Contractor for a specific project. The Site Safety Plan must identify hazards associated with the project, and include specific safety procedures and training appropriate and

necessary to complete the work. The Site Safety Plan must be submitted prior to the commencement of work at the site and is subject to review and acceptance by the Construction Safety Unit.

Unsafe or Unhealthy Condition: A condition that could be potentially hazardous to the health and safety of personnel or the public, and/or damaging to equipment, machinery, property or the environment.

Weekly Safety Meetings: Weekly documented jobsite safety meetings, given to all jobsite personnel by contractor, with the purpose of discussing general safety topics and job specific requirements encountered at the DDC work site.

Work: The construction required by the Contract Documents whether completed or partially completed, performed by the Contractor/ subcontractors. Work refers to the furnishing of labor, furnishing and incorporating materials and equipment into the construction and providing any service required by the Contract Documents to fulfill the Contractor's obligation to complete the Project.

IV. RESPONSIBILITIES

All persons who manage, perform, and provide support for construction projects shall conduct operations in compliance with the requirements identified in this Policy and all applicable governing regulatory agency requirements and guidelines pertaining to safety in construction.

A. DDC or CM Resident Engineer / Construction Project Manager

- Monitors the issuance of safety- related permits, approvals and drawings and maintains copies on site.
- Monitors construction-related work activities to confirm that they are conducted in accordance with DDC policies and all applicable regulations that pertain to construction safety.
- Maintains documentation and periodically attends weekly safety meetings and daily safety job briefings.
- Notifies the Construction Safety Unit and the ACCO's Insurance and Risk Management Unit of project- related accidents and emergencies, as per DDC's Construction Safety Emergency and Accident Notification and Response Protocol.
- Gathers facts related to all accidents and prepares DDC Construction Accident Report.
- Notifies the Construction Safety Unit within two (2) hours of the start of an inspection by any outside regulatory agency personnel, including OSHA, NYC DOB or others and forwards a copy of the inspection report within three days of its receipt.
- Monitors the conditions at the site for conformance with the contractor's Site Safety Plan and DDC construction documents.
- Notifies the contractor and DDC in the event that any condition or activity exists that is not in compliance with the contractor's Site Safety Plan, applicable federal, state or local codes or any condition that presents a potential risk of injury to the public or workers or possible damage to property.
- Notifies DDC of any unsafe or unhealthy condition and directs the contractor to provide such labor, materials, equipment and supervision to abate such conditions.
- Escort and assist QA&CS Construction Safety Auditors during the field and record inspections.
- Reports emergency conditions to the Construction Safety Unit immediately.

B. Contractors

- Submit a completed Safety Questionnaire and other safety performance related documentation with its bid or as part of a pre-qualification package.
- Complete a written Job Hazard Analysis (JHA) that identifies safety hazards for project specific work tasks and hazard control methods. A written JHA shall be available at the site for reference and included in the Site Safety Plan submitted by the contractor.
- Submit a Site Safety Plan and Safety Program within 30 days from the Award Date or as otherwise directed. The Site Safety Plan and Safety Program are subject to review and acceptance by the Construction Safety Unit prior to the commencement of work at the site. The Site Safety Plan shall be revised and updated as necessary.

- Develop project specific safety procedures to protect general public during all construction activities for the duration of the project.
- Ensure that all employees are aware of the hazards associated with the project through documented formal and informal training and/or other communications. Conduct and document weekly safety meetings and daily job briefing sessions for the duration of the project. Documentation to be provided to the RE/CPM on a monthly basis.
- Name the Project Safety Representative and Project Safety Manager, if required. The Contractor will be required to identify the Project Safety Representative and Project Safety Manager in the Site Safety Plan. Resumes, outlining the qualification and experience for the Project Safety Representative and Project Safety Manager, shall be available upon request. DDC reserves the right to request that the Contractor replace any Project Safety Representative or Project Safety Manager for any reason at any time during the project.
- Name a Competent Person(s), The Contractor will be required to identify a Competent Person(s) in the Site Safety Plan.
- Comply with all mandated federal, state and local safety and health rules and regulations.
- Comply with all provisions of the Site Safety Plan.
- Conduct applicable safety training prior to the commencement of work at the site. All training records (OSHA 10-hour, flagger, scaffold, fall protection, confined space entry, etc.) shall be provided to the RE/CPM prior to mobilization, included in the Site Safety Plan, kept current during the course of the project, and available for review. Prior to performing any work on DDC project all employees shall have successfully completed, within the previous five calendar years, a 10 Hour OSHA construction safety course.
- As part of the Site Safety Plan, prepare a site specific programs and plans, such as MPT plan, steel erection plan, confined space program, fall protection plan, demolition plan, etc. (if not otherwise provided in the contract documents) and comply with all of its provisions.
- Conduct and document site-specific safety orientation for Contractor personnel to review the hazards associated with the project as identified in the Site Safety Plan and the specific safety procedures and controls that will be used to protect workers, the general public and property. The Project Safety Representative and/or Project Safety Manager will conduct this training prior to mobilization and provide documentation to the RE/CPM.
- Provide, replace and adequately maintain at or around the project site, suitable and sufficient signage, lights, barricades and enclosures (fences, sidewalk sheds, netting, bracing, etc.).
- Report unsafe or unhealthy conditions to the RE/CPM as soon as practical, but no more than 24 hours after discovery, and take prompt actions to remove or abate such conditions.
- Report any accidents involving injuries to workers or the general public, as well as property damage, to the RE/CPM within one (1) hour.
- Following an accident, the Contractor shall not remove or alter any equipment, structure, material, or evidence related to the accident. Exception: Immediate emergency procedures taken to secure structures, temporary construction, operations, or equipment that pose a continued imminent danger or facilitate assistance for persons who are trapped or who have sustained bodily injury.
- Notify the RE/CPM within one (1) hour of the start of an inspection by any outside regulatory agency personnel, including OSHA, NYC DOB or others.
- Maintain all records pertaining to all required compliance documents and accident and injury reports.
- Address DDC recommendations on safety, which shall in no way relieve the Contractor of its responsibilities for safety on the project. The Contractor has sole responsibility for safety.

V. SAFETY QUESTIONNAIRE

DDC requires that all Contractors provide information regarding their current and past safety performance and programs. This will be accomplished by the use of the DDC Safety Questionnaire. As a part of the bid submittal package, the contractor must submit a completed DDC Safety Questionnaire listing company workers' compensation experience modification rating and OSHA Incident Rates for the three (3) years prior to the date of the bid opening. DDC may request a Contractor to update its Questionnaire at any time or to provide more detailed information. The Contractor must provide the requested information within 15 days.

The following criteria will be used by DDC in reviewing the Contractor's responsibility, which will be based on the information provided on the questionnaire:

Criteria 1: OSHA Injury and Illness Rates (I&IR) are no greater than the average for the industry (based on the most current Bureau of Labor Statistics data for the Contractors SIC code); and
Criteria 2: Insurance workers compensation Experience Modification Rate (EMR) equal to or less than 1.0; and
Criteria 3: Any willful violations issued by OSHA or NYC DOB within the last three (3) years; and
Criteria 4: A fatality (worker or member of public) and injuries, requiring OSHA notification, experienced on or near Contractor's worksite within the last three (3) years; and
Criteria 5: Past safety performance on DDC projects (accidents; status of safety program and site safety plan submittals; etc.)
Criteria 6: OSHA violation history for the last three (3) years;
Criteria 7: Contractor shall provide OSHA Injury and Illness Records (currently OSHA 300 and 300A Logs) for the last three (3) years.

If the Contractor fails to meet the basic criteria listed above, the Construction Safety Unit may request, through the ACCO, more details concerning the Contractor's safety experience. DDC may request the Contractor to provide copies of, among other things, accident investigation reports, OSHA records, OSHA and NYC DOB citations, EPA citations and written corrective action plan.

VI. SAFETY PROGRAM AND SITE SAFETY PLAN

Within thirty (30) days from the Award Date, or as otherwise directed, the Contractor shall submit the following: (1) Safety Program, and (2) Site Safety Plan. The Safety Program shall set forth the Contractor's overall safety policy, regulatory compliance plan and minimum safety standards. The Site Safety Plan shall identify project work scope, safety hazards associated with the project tasks, and include specific safety procedures and training appropriate and necessary to complete the work. The Safety Program and the Site Safety Plan are subject to review and acceptance by the Construction Safety Unit prior to the commencement of work at the site. Failure by the Contractor to submit an acceptable Site Safety Plan and Safety Program shall be grounds for default.

Safety Program: Corporate Safety Program established by the Contractor that includes the Contractor's overall safety policy, regulatory compliance plan and basic safety procedures covering all aspects of construction operations, performed by the Contractor. The Safety Program shall be a written document with a separate section describing each element of the Safety Program. The Safety Program shall have at minimum the following elements applicable to the Contractor's operations:

- Responsibility and Organization – Contractor's company organization chart, including titles, names, contact information, roles and responsibilities for key personnel, etc.
- Safety Training Program – Contractor's corporate training program.
- Hazard Corrective Actions – Criteria for safety inspections, identification of safety non-compliances, implementation and verification of corrective actions, forms to document safety inspections results, etc.
- Accident/Exposure Investigation
- Recordkeeping and Reporting Injuries – Responsible staff; reporting and recording criteria; OSHA 300 and 300A form completion, etc.
- Fire Protection and Prevention Program
- Housekeeping
- Illumination
- Sanitation
- Personal Protective Equipment (PPE) – Company policy for the use of head protection, foot protection, hearing protection, eye and face protection, protective clothing, and any additional protective equipment based on work tasks; PPE inspection and replacement policy.
- Hazard Communication Program
- Employee Emergency Action Plan
- Protection of Underground Facilities and Utilities
- Ionizing/Nonionizing Radiation
- Material Handling, Storage, Use and Disposal
- Tools – Hand and Power
- Signs, Signals, and Barricades

- Scaffold – Local Law 52 requirements, installation, use, inspection, dismantling, training and general safety requirements.
- Welding and Cutting
- Electrical Safety
- Fall Protection
- Cranes, Derrick, Hoists, Elevators, Conveyors
- Excavation Safety
- Concrete and Masonry Construction
- Maintenance and Protection of Traffic
- Steel Erection
- Demolition
- Blasting and the Use of Explosives
- Stairways and Ladders
- Toxic and Hazardous Substances
- Alcohol and Drug Abuse Policy
- Rodents and Vermin
- Occupational Noise Exposure
- Confined Space Program – General confined Space Program: training requirements, confined space hazard evaluation procedure, atmospheric testing procedure, confined space classification, permit-required procedure, communication procedure, rescue procedure, forms, etc.
- Construction Vehicles/Heavy Equipment
- Dust Control Procedures

Site Safety Plan: The Site Safety Plan shall be a written document and shall apply to all project specific Contractor and subcontractor operations, and shall have at a minimum, the following elements with each element described in a separate section (It may be necessary to modify the basic format for certain unique or high-risk projects, such as tunnels or high-rise construction):

- Project Work Scope – Detailed information regarding work tasks that will be performed by contractor and subcontractors under the project.
- Responsibility and Organization – Contractor's organization chart with responsible staff for the project, including titles, names, contact information, roles and responsibilities.
- Safety Training and Education – OSHA 10 Hours training, requirements for daily safety briefings and weekly safety meetings, any work task specific training, responsible staff for implementation of training program for the project.
- Job Hazard Analysis (JHA) – Project specific Job Hazard Analysis including work tasks, identified hazards, hazard control methods (administrative, engineering, PPE), contractor's name, project id, location, name and signature of a certifying person, hazard assessment date.
- Protection of Public
- Hazard Corrective Actions – Responsible staff, forms, frequency of safety inspections and implementation of corrective actions.
- Accident/Exposure Investigation – Accident/incident notification procedure of DDC project staff. Project specific procedures for accident investigation and implementation of corrective actions.
- First Aid and Medical Attention – Responsible staff, location and inspection of First Aid kit, directions to local hospitals; emergency telephone numbers.
- Project Specific Fire Protection and Prevention Program.
- Project Specific Illumination Procedure.
- Project Specific Sanitation Procedure.
- Personal Protective Equipment (PPE)
- Hazard Communication Program – Responsible staff; training; SDS records, project specific list of chemical; location of the program and SDS records.
- Means of Egress – Information regarding free and unobstructed egress from all parts of the building or structure; exit marking; maintenance of means of egress, etc.
- Employee Emergency Action Plan – Project specific: responsible staff, emergency alarm system, evacuation procedure, procedure to account for employees after evacuation, etc.
- Evacuation Plan – Project specific evacuation plan (drawing/scheme) with exists and evacuation routes.

- Protection of Underground Facilities and Utilities, including responsible staff.
- Ionizing/Nonionizing Radiation – Competent person, license and qualification requirements, type of radiation, employees exposure and protection, etc.
- Material Handling, Storage, Use and Disposal – Project specific information regarding material storage and disposal.
- Signs, Signals, and Barricades – Use of danger/warning signs, sidewalk closure, safety instruction signs, pedestrian fencing and barricades, etc.
- Scaffold – Project specific scaffold types, training, scaffold drawings, competent person, criteria for project specific scaffold, falling object protection.
- Welding and Cutting – project specific procedure for welding and cutting, including all necessary safety requirements such as fire prevention, personal protective equipment, hot work permits, FDNY certificate requirements.
- Fall Protection – Project specific information regarding selected fall protection systems, fall protection plan.
- Cranes, Derrick, Hoists, Elevators, Conveyors – project specific equipment information including type, rated load capacity, manufacture specification requirements, competent person, exposure to falling load, inspection, recordkeeping, clearance requirements, communication procedure, ground lines, permits.
- Excavation Safety – Competent person, project specific protective system.
- Maintenance and Protection of Traffic Plan – Project specific MPT plan, flagmen training.
- Steel Erection – Site specific erection plan, requirements for applicable written notifications, competent person.
- Demolition – Engineering survey, including written evidence, disconnection of all effected utilities, identification of all hazardous chemicals, materials, gases, etc., floor openings, chutes, inspection and maintenance of all stairs/passageways, removal of materials/debris/structural elements, lock out/tag out, competent person.
- Blasting and the Use of Explosives – Project specific safety procedures, warning signs, training/qualification, transportation, storage and use of explosives, inspection.
- Toxic and Hazardous Substances – Safety procedures for substances to be used on project.
- Noise Mitigation Plan – Completed project specific Noise Mitigation Plan.
- Confined Space Program – Project specific Confined Space Program, responsible staff, training records, equipment information, rescue procedure, list of project specific confined spaces, forms.
- Construction Vehicles/Heavy Equipment – Type of construction vehicles/heavy equipment to be used on site.
- Dust Mitigation Plan – Completed project specific Dust Mitigation Plan.

The most critical component of the Site Safety Plan is the Job Hazard Analysis (JHA) section. The JHA form is a written document prepared by the contractor. The contractor must conduct a site and task assessment JHA to identify the major job steps and any potential safety or environmental hazards related to performance of the work, eliminate or implement controls for the potential hazards, and identify proper personal protective equipment for the task. The JHA shall be communicated to all contractor/subcontractor personnel on site.
The initial Job Hazard Assessment form shall be included in the contractor's Site Safety Plan and the current form shall be available at the construction site for reference.

Certain DDC programs, such as Job Order Contracting System (JOCS), may not necessarily require Site Safety Plans. The JOCS contractor shall submit a Safety Program. The Site Safety Plan requirement for the JOCS contractor will be determined by QA&CS based on a project work scope, construction activities and project location. In addition, certain DDC Operating Units may establish client-specific program or safety requirements. The contractor's Site Safety Plan must address such client-specific program or safety requirements.

VII. KICK-OFF MEETINGS/PRE-CONSTRUCTION AND SAFETY REVIEW

RE/CPM shall invite QA&CS Construction Safety Unit to the construction kick-off meeting. A QA&CS representative will participate in this meeting with the Contractor and RE/CPM prior to the start of the project for the purpose of:

A. Reviewing the safety issues detailed in the contract.
B. Reviewing the Site Safety Plan.
C. Reviewing any new issues or information that was not previously addressed.
D. Discussing planned inspections and audits of the site by QA&CS personnel.

VIII. EVALUATION DURING WORK IN PROGRESS

The Contractor's adherence to these Safety Requirements will be monitored throughout the project. This will be accomplished by the following:

A. Use of a safety checklist by a representative of the Construction Safety Unit or other designated DDC representative or Consultant during regular, unannounced inspections of the job site. Field Exit Conferences will be held with the RE/CPM, Contractor Project Safety Representatives.

B. The RE/CPM will continually monitor the safety and environmental performance of the contractor's employees and work methods. Deficiencies shall be brought to the attention of the contractor's representative on site for immediate correction. The DDC representative will maintain a written record of these deficiencies and have these records available upon request. Any critical deficiencies shall be immediately reported to QA&CS phone# (718) 391-1624 or (718) 391-1911.

C. If the Contractor's safety performance during the project is not up to DDC standards (safety performance measure, accident/incident rate, etc.) the Director – QA&CS, or his/her designee will meet with the Contractor's Project Safety Representative and or Project Safety Manager, the DDC Project Manager, the RE/CPM, and the DDC Environmental Specialist (if environmental issues are involved). The purpose of this meeting is to 1) determine the level of non-compliance; 2) explain and clarify the safety/environmental provisions; 3) agree on a future course of action to correct the deficiencies.

D. If the deficiencies continue to occur with inadequate attention by the contractor, this shall, among other remedies available, be grounds for default.

E. The contractor shall within 1 hour inform the RE/CPM/CM of all accidents/incidents including all fatalities, any injuries to employees or members of the general public, and property damage (e.g., structural damage, equipment rollovers, utility damage, loads dropped from crane). The RE/CPM shall notify the Construction Safety Unit as per DDC's Construction Safety Emergency and Accident Notification and Response Protocol and shall maintain a record of all contractor accidents/incidents for the project.

F. The Construction Safety Unit shall be notified within two (2) hours of the start of any NYS-DOL/ NYC-COSH/ OSHA/ EPA inspections.

IX. SAFETY PERFORMANCE EVALUATION

The contractor's safety record, including accident/incident history and DDC safety inspection results, will be considered as part of the Contractor's performance evaluation at the conclusion of the project. Poor safety performance during the course of the project shall be a reason to rate a Contractor unsatisfactory which may be reflected in the City's Vendex system and will be considered for future procurement actions as set forth in the City's Procurement Policy Board Rules.

CITY OF NEW YORK

STANDARD CONSTRUCTION CONTRACT

March 2017

CITY OF NEW YORK
STANDARD CONSTRUCTION CONTRACT

TABLE OF CONTENTS

CHAPTER I: THE CONTRACT AND DEFINITIONS 1
ARTICLE 1. THE CONTRACT 1
ARTICLE 2. DEFINITIONS 1
CHAPTER II: THE WORK AND ITS PERFORMANCE 4
ARTICLE 3. CHARACTER OF THE WORK 4
ARTICLE 4. MEANS AND METHODS OF CONSTRUCTION 4
ARTICLE 5. COMPLIANCE WITH LAWS 5
ARTICLE 6. INSPECTION 10
ARTICLE 7. PROTECTION OF WORK AND OF PERSONS AND PROPERTY; NOTICES AND INDEMNIFICATION 11
CHAPTER III: TIME PROVISIONS 12
ARTICLE 8. COMMENCEMENT AND PROSECUTION OF THE WORK 12
ARTICLE 9. PROGRESS SCHEDULES 13
ARTICLE 10. REQUESTS FOR INFORMATION OR APPROVAL 13
ARTICLE 11. NOTICE OF CONDITIONS CAUSING DELAY AND DOCUMENTATION OF DAMAGES CAUSED BY DELAY 14
ARTICLE 12. COORDINATION WITH OTHER CONTRACTORS 18
ARTICLE 13. EXTENSION OF TIME FOR PERFORMANCE 19
ARTICLE 14. COMPLETION AND FINAL ACCEPTANCE OF THE WORK 21
ARTICLE 15. LIQUIDATED DAMAGES 23
ARTICLE 16. OCCUPATION OR USE PRIOR TO COMPLETION 23
CHAPTER IV: SUBCONTRACTS AND ASSIGNMENTS 24
ARTICLE 17. SUBCONTRACTS 24
ARTICLE 18. ASSIGNMENTS 26
CHAPTER V: CONTRACTOR'S SECURITY AND GUARANTEE 26
ARTICLE 19. SECURITY DEPOSIT 26
ARTICLE 20. PAYMENT GUARANTEE 27
ARTICLE 21. RETAINED PERCENTAGE 29
ARTICLE 22. INSURANCE 30
ARTICLE 23. MONEY RETAINED AGAINST CLAIMS 36
ARTICLE 24. MAINTENANCE AND GUARANTY 37
CHAPTER VI: CHANGES, EXTRA WORK, AND DOCUMENTATION OF CLAIM 38
ARTICLE 25. CHANGES 38
ARTICLE 26. METHODS OF PAYMENT FOR OVERRUNS AND EXTRA WORK 38
ARTICLE 27. RESOLUTION OF DISPUTES 41
ARTICLE 28. RECORD KEEPING FOR EXTRA OR DISPUTED WORK OR WORK ON A TIME & MATERIALS BASIS 45
ARTICLE 29. OMITTED WORK 46
ARTICLE 30. NOTICE AND DOCUMENTATION OF COSTS AND DAMAGES; PRODUCTION OF FINANCIAL RECORDS 46
CHAPTER VII: POWERS OF THE RESIDENT ENGINEER,THE ENGINEER OR ARCHITECT AND THE COMMISSIONER 48
ARTICLE 31. THE RESIDENT ENGINEER 48
ARTICLE 32. THE ENGINEER OR ARCHITECT OR PROJECT MANAGER 48
ARTICLE 33. THE COMMISSIONER 48
ARTICLE 34. NO ESTOPPEL 49
CHAPTER VIII: LABOR PROVISIONS 49
ARTICLE 35. EMPLOYEES 49
ARTICLE 36. NO DISCRIMINATION 57
ARTICLE 37. LABOR LAW REQUIREMENTS 59

ARTICLE 38. PAYROLL REPORTS 64
ARTICLE 39. DUST HAZARDS 64
CHAPTER IX: PARTIAL AND FINAL PAYMENTS 65
ARTICLE 40. CONTRACT PRICE 65
ARTICLE 41. BID BREAKDOWN ON LUMP SUM 65
ARTICLE 42. PARTIAL PAYMENTS 65
ARTICLE 43. PROMPT PAYMENT 66
ARTICLE 44. SUBSTANTIAL COMPLETION PAYMENT 66
ARTICLE 45. FINAL PAYMENT 67
ARTICLE 46. ACCEPTANCE OF FINAL PAYMENT 68
ARTICLE 47. APPROVAL BY PUBLIC DESIGN COMMISSION 69
CHAPTER X: CONTRACTOR'S DEFAULT 69
ARTICLE 48. COMMISSIONER'S RIGHT TO DECLARE CONTRACTOR IN DEFAULT 69
ARTICLE 49. EXERCISE OF THE RIGHT TO DECLARE DEFAULT 71
ARTICLE 50. QUITTING THE SITE 71
ARTICLE 51. COMPLETION OF THE WORK 71
ARTICLE 52. PARTIAL DEFAULT 71
ARTICLE 53. PERFORMANCE OF UNCOMPLETED WORK 72
ARTICLE 54. OTHER REMEDIES 72
CHAPTER XI: MISCELLANEOUS PROVISIONS 72
ARTICLE 55. CONTRACTOR'S WARRANTIES 72
ARTICLE 56. CLAIMS AND ACTIONS THEREON 73
ARTICLE 57. INFRINGEMENT 73
ARTICLE 58. NO CLAIM AGAINST OFFICIALS, AGENTS OR EMPLOYEES 74
ARTICLE 59. SERVICE OF NOTICES 74
ARTICLE 60. UNLAWFUL PROVISIONS DEEMED STRICKEN FROM CONTRACT 74
ARTICLE 61. ALL LEGAL PROVISIONS DEEMED INCLUDED 74
ARTICLE 62. TAX EXEMPTION 74
ARTICLE 63. INVESTIGATION(S) CLAUSE 76
ARTICLE 64. TERMINATION BY THE CITY 78
ARTICLE 65. CHOICE OF LAW, CONSENT TO JURISDICTION AND VENUE 80
ARTICLE 66. PARTICIPATION IN AN INTERNATIONAL BOYCOTT 81
ARTICLE 67. LOCALLY BASED ENTERPRISE PROGRAM 82
ARTICLE 68. ANTITRUST 82
ARTICLE 69. MACBRIDE PRINCIPLES PROVISIONS 83
ARTICLE 70. ELECTRONIC FILING/NYC DEVELOPMENT HUB 85
ARTICLE 71. PROHIBITION OF TROPICAL HARDWOODS 85
ARTICLE 72. CONFLICTS OF INTEREST 85
ARTICLE 73. MERGER CLAUSE 85
ARTICLE 74. STATEMENT OF WORK 85
ARTICLE 75. COMPENSATION TO BE PAID TO CONTRACTOR 85
ARTICLE 76. ELECTRONIC FUNDS TRANSFER 85
ARTICLE 77. RECORDS RETENTION 86
ARTICLE 78. EXAMINATION AND VIEWING OF SITE, CONSIDERATION OF OTHER SOURCES OF INFORMATION AND CHANGED SITE CONDITIONS 86

ARTICLE 79: PARTICIPATION BY MINORITY-OWNED AND WOMEN-OWNED BUSINESS ENTERPRISES IN CITY PROCUREMENT 87

SIGNATURES 95

ACKNOWLEDGMENT BY CORPORATION 96
ACKNOWLEDGMENT BY PARTNERSHIP.....96
ACKNOWLEDGMENT BY INDIVIDUAL 96

ACKNOWLEDGMENT BY COMMISSIONER 97

AUTHORITY 98
COMPTROLLER'S CERTIFICATE 98
MAYOR'S CERTIFICATE 99
PERFORMANCE BOND #1 100
PERFORMANCE BOND #2.....104
PAYMENT BOND 108

WITNESSETH:

The parties, in consideration of the mutual agreements contained herein, agree as follows:

CHAPTER I: THE CONTRACT AND DEFINITIONS

ARTICLE 1. THE CONTRACT

1.1 Except for titles, subtitles, headings, running headlines, tables of contents and indices (all of which are printed herein merely for convenience), the following, except for such portions thereof as may be specifically excluded, shall be deemed to be part of this **Contract**:

1.1.1 All provisions required by law to be inserted in this **Contract**, whether actually inserted or not;

1.1.2 The Contract Drawings and Specifications;

1.1.3 The General Conditions and Special Conditions, if any;

1.1.4 The **Contract**;

1.1.5 The Information for Bidders; Request for Proposals; Notice of Solicitation and Proposal For Bids; Bid or Proposal, and, if used, the Bid Booklet;

1.1.6 All Addenda issued prior to the receipt of the bids; the Notice of Award; Performance and Payment Bonds, if required; and the Notice to Proceed or the Order to Work.

1.2 Should any conflict occur in or between the Drawings and Specifications, the **Contractor** shall be deemed to have estimated the most expensive way of doing the **Work**, unless the **Contractor** shall have asked for and obtained a decision in writing from the **Commissioner** of the **Agency** that is entering into this **Contract**, before the submission of its bid, as to what shall govern.

ARTICLE 2. DEFINITIONS

2.1 The following words and expressions, or pronouns used in their stead, shall, wherever they appear in this Contract, be construed as follows, unless a different meaning is clear from the context:

2.1.1 **"Addendum"** or **"Addenda"** shall mean the additional Contract provisions and/or technical clarifications issued in writing by the Commissioner prior to the receipt of bids.

2.1.2 **"Agency"** shall mean a city, county, borough or other office, position, department, division, bureau, board or commission, or a corporation, institution or agency of government, the expenses of which are paid in whole or in part from the City treasury.

2.1.3 **"Agency Chief Contracting Officer" (ACCO)** shall mean a person delegated authority by the Commissioner to organize and supervise the procurement activity of subordinate Agency staff in conjunction with the CCPO, or his/her duly authorized representative.

2.1.4 **"Allowance"** shall mean a sum of money which the Agency may include in the total amount of the Contract for such specific contingencies as the Agency believes may be necessary to complete the Work, *e.g.*, lead or asbestos remediation, and for which the Contractor will be paid on the basis of stipulated unit prices or a formula set forth in the Contract or negotiated between the parties provided, however, that if the Contractor is not directed to use the Allowance, the Contractor shall have no right to such money and it shall be deducted from the total amount of the Contract.

2.1.5 **"City"** shall mean the City of New York.

2.1.6 **"City Chief Procurement Officer" (CCPO)** shall mean a person delegated authority by the Mayor to coordinate and oversee the procurement activity of Mayoral agency staff, including the ACCO and any offices which have oversight responsibility for the procurement of construction, or his/her duly authorized representative.

2.1.7 **"Commissioner"** shall mean the head of the Agency that has entered into this Contract, or his/her duly authorized representative.

2.1.8 **"Comptroller"** shall mean the Comptroller of the City of New York.

2.1.9 **"Contract"** or **"Contract Documents"** shall mean each of the various parts of the contract referred to in Article 1 hereof, both as a whole and severally.

2.1.10 **"Contract Drawings"** shall mean only those drawings specifically entitled as such and listed in the Specifications or in any Addendum, or any drawings furnished by the Commissioner, pertaining or supplemental thereto.

2.1.11 **"Contract Work"** shall mean everything required to be furnished and done by the Contractor by any one or more of the parts of the Contract referred to in Article 1, except Extra Work as hereinafter defined.

2.1.12 **"Contractor"** shall mean the entity which executed this Contract, whether a corporation, firm, partnership, joint venture, individual, or any combination thereof, and its, their, his/her successors, personal representatives, executors, administrators, and assigns, and any person, firm, partnership, joint venture, individual, or corporation which shall at any time be substituted in the place of the Contractor under this Contract.

2.1.13 **"Days"** shall mean calendar days, except where otherwise specified.

2.1.14 **"Engineer"** or **"Architect"** or **"Project Manager"** shall mean the person so designated in writing by the Commissioner in the Notice to Proceed or the Order to Work to act as such in relation to this Contract, including a private Architect or Engineer or Project Manager, as the case may be. Subject to written approval by the Commissioner, the Engineer, Architect or Project Manager may designate an authorized representative.

2.1.15 **"Engineering Audit Officer" (EAO)** shall mean the person so designated by the Commissioner to perform responsible auditing functions hereunder.

2.1.16 **"Extra Work"** shall mean Work other than that required by the Contract at the time of award which is authorized by the Commissioner pursuant to Chapter VI of this Contract.

2.1.17 **"Federal-Aid Contract"** shall mean a contract in which the United States (federal) Government provides financial funding as so designated in the Information for Bidders.

2.1.18 **"Final Acceptance"** shall mean final written acceptance of all the Work by the Commissioner, a copy of which shall be sent to the Contractor.

2.1.19 **"Final Approved Punch List"** shall mean a list, approved pursuant to Article 14.2.2, specifying those items of Work to be completed by the Contractor after Substantial Completion and dates for the completion of each item of Work.

2.1.20 **"Law"** or **"Laws"** shall mean the Constitution of the State of New York, the New York City Charter, the New York City Administrative Code, a statute of the United States or of the State of New York, a local law of the City of New York, any ordinance, rule or regulation having the force of law, or common law.

2.1.21 **"Materialman"** shall mean any corporation, firm, partnership, joint venture, or individual, other than employees of the Contractor, who or which contracts with the Contractor or any Subcontractor, to fabricate or deliver, or who actually fabricates or delivers, plant, materials or equipment to be incorporated in the Work.

2.1.22 **"Means and Methods of Construction"** shall mean the labor, materials, temporary structures, tools, plant, and construction equipment, and the manner and time of their use, necessary to accomplish the result intended by this Contract.

2.1.23**"Notice to Proceed" or "Order to Work"** shall mean the written notice issued by the Commissioner specifying the time for commencement of the Work and the Engineer, Architect or Project Manager.

2.1.24 **"Other Contractor(s)"** shall mean any contractor (other than the entity which executed this Contract or its Subcontractors) who or which has a contract with the City for work on or adjacent to the building or Site of the Work.

2.1.25 **"Payroll Taxes"** shall mean State Unemployment Insurance (SUI), Federal Unemployment Insurance (FUI), and payments pursuant to the Federal Insurance Contributions Act (FICA).

2.1.26 **"Project"** shall mean the public improvement to which this Contract relates.

2.1.27 **"Procurement Policy Board" (PPB)** shall mean the Agency of the City of New York whose function is to establish comprehensive and consistent procurement policies and rules which shall have broad application throughout the City.

2.1.28 **"Required Quantity"** in a unit price Contract shall mean the actual quantity of any item of Work or materials which is required to be performed or furnished in order to comply with the Contract.

2.1.29 **"Resident Engineer"** shall mean the representative of the Commissioner duly designated by the Commissioner to be his/her representative at the site of the Work.

2.1.30 **"Site"** shall mean the area upon or in which the Contractor's operations are carried on, and such other areas adjacent thereto as may be designated as such by the Engineer.

2.1.31 **"Small Tools"** shall mean items that are ordinarily required for a worker's job function, including but not limited to, equipment that ordinarily has no licensing, insurance or substantive storage costs associated with it; such as circular and chain saws, impact drills, threaders, benders, wrenches, socket tools, etc.

2.1.32 **"Specifications"** shall mean all of the directions, requirements, and standards of performance applying to the Work as hereinafter detailed and designated under the Specifications.

2.1.33 **"Subcontractor"** shall mean any person, firm or corporation, other than employees of the Contractor, who or which contracts with the Contractor or with its subcontractors to furnish, or actually furnishes labor, or labor and materials, or labor and equipment, or superintendence, supervision and/or management at the Site. Wherever the word Subcontractor appears, it shall also mean sub-Subcontractor.

2.1.34 **"Substantial Completion"** shall mean the written determination by the Engineer that the Work required under this Contract is substantially, but not entirely, complete and the approval of the **Final Approved Punch List**.

2.1.35 **"Work"** shall mean all services required to complete the Project in accordance with the Contract Documents, including without limitation, labor, material, superintendence, management, administration, equipment, and incidentals, and obtaining any and all permits, certifications and licenses as may be necessary and required to complete the Work, and shall include both Contract Work and Extra Work.

CHAPTER II: THE WORK AND ITS PERFORMANCE

ARTICLE 3. CHARACTER OF THE WORK

3.1 Unless otherwise expressly provided in the **Contract Drawings**, **Specifications,** and **Addenda**, the **Work** shall be performed in accordance with the best modern practice, utilizing, unless otherwise specified in writing, new and unused materials of standard first grade quality and workmanship and design of the highest quality, to the satisfaction of the **Commissioner**.

ARTICLE 4. MEANS AND METHODS OF CONSTRUCTION

4.1 Unless otherwise expressly provided in the **Contract Drawings**, **Specifications,** and **Addenda**, the **Means and Methods of Construction** shall be such as the **Contractor** may choose; subject, however, to the **Engineer's** right to reject the **Means and Methods of Construction** proposed by the **Contractor** which in the opinion of the **Engineer**:

4.1.1 Will constitute or create a hazard to the **Work**, or to persons or property; or

4.1.2 Will not produce finished **Work** in accordance with the terms of the **Contract**; or

4.1.3 Will be detrimental to the overall progress of the **Project**.

4.2 The **Engineer's** approval of the **Contractor's Means and Methods of Construction**, or his/her failure to exercise his/her right to reject such means or methods, shall not relieve the **Contractor**

of its obligation to complete the **Work** as provided in this **Contract**; nor shall the exercise of such right to reject create a cause of action for damages.

ARTICLE 5. COMPLIANCE WITH LAWS

5.1 The **Contractor** shall comply with all **Laws** applicable to this **Contract** and to the **Work** to be done hereunder.

5.2 Procurement Policy Board Rules: This **Contract** is subject to the Rules of the **PPB** ("**PPB** Rules") in effect at the time of the bid opening for this **Contract**. In the event of a conflict between the **PPB** Rules and a provision of this **Contract**, the **PPB** Rules shall take precedence.

5.3 Noise Control Code provisions.

5.3.1 In accordance with the provisions of Section 24-216(b) of the Administrative Code of the **City** ("Administrative Code"), Noise Abatement Contract Compliance, devices and activities which will be operated, conducted, constructed or manufactured pursuant to this **Contract** and which are subject to the provisions of the **City** Noise Control Code shall be operated, conducted, constructed, or manufactured without causing a violation of the Administrative Code. Such devices and activities shall incorporate advances in the art of noise control development for the kind and level of noise emitted or produced by such devices and activities, in accordance with regulations issued by the **Commissioner** of the **City** Department of Environmental Protection.

5.3.2 The **Contractor** agrees to comply with Section 24-219 of the Administrative Code and implementing rules codified at 15 Rules of the City of New York ("RCNY") Section 28-100 *et seq*. In accordance with such provisions, the **Contractor**, if the **Contractor** is the responsible party under such regulations, shall prepare and post a Construction Noise Mitigation Plan at each **Site**, in which the **Contractor** shall certify that all construction tools and equipment have been maintained so that they operate at normal manufacturers operating specifications. If the **Contractor** cannot make this certification, it must have in place an Alternative Noise Mitigation Plan approved by the **City** Department of Environmental Protection. In addition, the **Contractor**'s certified Construction Noise Mitigation Plan is subject inspection by the **City** Department of Environmental Protection in accordance with Section 28-101 of Title 15 of RCNY. No **Contract Work** may take place at a **Site** unless there is a Construction Noise Mitigation Plan or approved Alternative Noise Mitigation Plan in place. In addition, the **Contractor** shall create and implement a noise mitigation training program. Failure to comply with these requirements may result in fines and other penalties pursuant to the applicable provisions of the Administrative Code and RCNY.

5.4 Ultra Low Sulfur Diesel Fuel: In accordance with the provisions of Section 24-163.3 of the Administrative Code, the **Contractor** specifically agrees as follows:

5.4.1 Definitions. For purposes of this Article 5.4, the following definitions apply:

5.4.1(a) "Contractor" means any person or entity that enters into a Public Works Contract with a **City Agency**, or any person or entity that enters into an agreement with such person or entity, to perform work or provide labor or services related to such Public Works Contract.

5.4.1(b) "Motor Vehicle" means any self-propelled vehicle designed for transporting persons or property on a street or highway.

5.4.1(c) "Nonroad Engine" means an internal combustion engine (including the fuel system) that is not used in a Motor Vehicle or a vehicle used solely for competition, or that is not subject to standards promulgated under Section 7411 or Section 7521 of Title 42 of the United States Code, except that this term shall apply to internal combustion engines used to power generators, compressors or similar equipment used in any construction program or project.

5.4.1(d) "Nonroad Vehicle" means a vehicle that is powered by a Nonroad Engine, fifty (50) horsepower and greater, and that is not a Motor Vehicle or a vehicle used solely for competition, which shall include, but not be limited to, excavators, backhoes, cranes, compressors, generators, bulldozers, and similar equipment, except that this term shall not apply to horticultural maintenance vehicles used for landscaping purposes that are powered by a Nonroad Engine of sixty-five (65) horsepower or less and that are not used in any construction program or project.

5.4.1(e) "Public Works Contract" means a contract with a **City Agency** for a construction program or project involving the construction, demolition, restoration, rehabilitation, repair, renovation, or abatement of any building, structure, tunnel, excavation, roadway, park or bridge; a contract with a **City Agency** for the preparation for any construction program or project involving the construction, demolition, restoration, rehabilitation, repair, renovation, or abatement of any building, structure, tunnel, excavation, roadway, park or bridge; or a contract with a **City Agency** for any final work involved in the completion of any construction program or project involving the construction, demolition, restoration, rehabilitation, repair, renovation, or abatement of any building, structure, tunnel, excavation, roadway, park or bridge.

5.4.1(f) "Ultra Low Sulfur Diesel Fuel" means diesel fuel that has a sulfur content of no more than fifteen parts per million (15 ppm).

5.4.2 Ultra Low Sulfur Diesel Fuel

5.4.2(a) All **Contractors** shall use Ultra Low Sulfur Diesel Fuel in diesel-powered Nonroad Vehicles in the performance of this **Contract**.

5.4.2(b) Notwithstanding the requirements of Article 5.4.2(a), **Contractors** may use diesel fuel that has a sulfur content of no more than thirty parts per million (30 ppm) to fulfill the requirements of this Article 5.4.2, where the Commissioner of the **City** Department of Environmental Protection ("DEP Commissioner") has issued a determination that a sufficient quantity of Ultra Low Sulfur Diesel Fuel is not available to meet the needs of **Agencies** and **Contractors**. Any such determination shall expire after six (6) months unless renewed.

5.4.2(c) **Contractors** shall not be required to comply with this Article 5.4.2 where the **City Agency** letting this **Contract** makes a written finding, which is approved, in writing, by the DEP Commissioner, that a sufficient quantity of Ultra Low Sulfur Diesel Fuel, or diesel fuel that has a sulfur content of no more than thirty parts per million (30 ppm) is not available to meet the requirements of Section 24-163.3 of the Administrative Code, provided that such **Contractor** in its fulfillment of the

requirements of this **Contract**, to the extent practicable, shall use whatever quantity of Ultra Low Sulfur Diesel Fuel or diesel fuel that has a sulfur content of no more than thirty parts per million (30 ppm) is available. Any finding made pursuant to this Article 5.4.2(c) shall expire after sixty (60) **Days**, at which time the requirements of this Article 5.4.2 shall be in full force and effect unless the **City Agency** renews the finding in writing and such renewal is approved by the DEP Commissioner.

5.4.2(d) **Contractors** may check on determinations and approvals issued by the DEP Commissioner pursuant to Section 24-163.3 of the Administrative Code, if any, at www.dep.nyc.gov or by contacting the **City Agency** letting this **Contract**.

5.4.2(e) The requirements of this Article 5.4.2 do not apply where they are precluded by federal or State funding requirements or where the **Contract** is an emergency procurement.

5.4.3 Best Available Technology

5.4.3(a) All **Contractors** shall utilize the best available technology for reducing the emission of pollutants for diesel-powered Nonroad Vehicles in the performance of this **Contract**. For determinations of best available technology for each type of diesel-powered Nonroad Vehicle, **Contractors** shall comply with the regulations of the **City** Department of Environmental Protection, as and when adopted, Chapter 14 of Title 15 of the Rules of the City of New York (RCNY). The **Contractor** shall fully document all steps in the best available technology selection process and shall furnish such documentation to the **City Agency** or the DEP Commissioner upon request. The **Contractor** shall retain all documentation generated in the best available technology selection process for as long as the selected best available technology is in use.

5.4.3(b) No **Contractor** shall be required to replace best available technology for reducing the emission of pollutants or other authorized technology utilized for a diesel-powered Nonroad Vehicle in accordance with the provisions of this Article 5.4.3 within three (3) years of having first utilized such technology for such vehicle.

5.4.3(c) This Article 5.4.3 shall not apply to any vehicle used to satisfy the requirements of a specific Public Works Contract for fewer than twenty (20) **Days**.

5.4.3(d) The **Contractor** shall not be required to comply with this Article 5.4.3 with respect to a diesel-powered Nonroad Vehicle under the following circumstances:

5.4.3(d)(i) Where the **City Agency** makes a written finding, which is approved, in writing, by the DEP Commissioner, that the best available technology for reducing the emission of pollutants as required by this Article 5.4.3 is unavailable for such vehicle, the **Contractor** shall use whatever technology for reducing the emission of pollutants, if any, is available and appropriate for such vehicle.

5.4.3(d)(ii) Where the DEP Commissioner has issued a written waiver based upon the **Contractor** having demonstrated to the DEP Commissioner that the use of the best available technology for reducing the emission of pollutants might endanger the operator of such vehicle or those working near such vehicle, due to engine malfunction, the **Contractor** shall use whatever technology for

reducing the emission of pollutants, if any, is available and appropriate for such vehicle, which would not endanger the operator of such vehicle or those working near such vehicle.

5.4.3(d)(iii) In determining which technology to use for the purposes of Articles 5.4.3(d)(i) and 5.4.3(d)(ii) above, the **Contractor** shall primarily consider the reduction in emissions of particulate matter and secondarily consider the reduction in emissions of nitrogen oxides associated with the use of such technology, which shall in no event result in an increase in the emissions of either such pollutant.

5.4.3(d)(iv) The **Contractor** shall submit requests for a finding or a waiver pursuant to this Article 5.4.3(d) in writing to the DEP Commissioner, with a copy to the **ACCO** of the **City Agency** letting this **Contract**. Any finding or waiver made or issued pursuant to Articles 5.4.3(d)(i) and 5.4.3(d)(ii) above shall expire after one hundred eighty (180) **Days**, at which time the requirements of Article 5.4.3(a) shall be in full force and effect unless the **City Agency** renews the finding, in writing, and the DEP Commissioner approves such finding, in writing, or the DEP Commissioner renews the waiver, in writing.

5.4.3(e) The requirements of this Article 5.4.3 do not apply where they are precluded by federal or State funding requirements or where the **Contract** is an emergency procurement.

5.4.4 Section 24-163 of the Administrative Code. The **Contractor** shall comply with Section 24-163 of the Administrative Code related to the idling of the engines of motor vehicles while parking.

5.4.5 Compliance

5.4.5(a) The **Contractor's** compliance with Article 5.4 may be independently monitored. If it is determined that the **Contractor** has failed to comply with any provision of Article 5.4, any costs associated with any independent monitoring incurred by the **City** shall be reimbursed by the **Contractor**.

5.4.5(b) Any **Contractor** who violates any provision of Article 5.4, except as provided in Article 5.4.5(c) below, shall be liable for a civil penalty between the amounts of one thousand ($1,000) and ten thousand ($10,000) dollars, in addition to twice the amount of money saved by such **Contractor** for failure to comply with Article 5.4.

5.4.5(c) No **Contractor** shall make a false claim with respect to the provisions of Article 5.4 to a **City Agency**. Where a **Contractor** has been found to have done so, such **Contractor** shall be liable for a civil penalty of twenty thousand ($20,000) dollars, in addition to twice the amount of money saved by such **Contractor** in association with having made such false claim.

5.4.6 Reporting

5.4.6(a) For all Public Works Contracts covered by this Article 5.4, the **Contractor** shall report to the **City Agency** the following information:

5.4.6(a)(i) The total number of diesel-powered Nonroad Vehicles used to fulfill the requirements of this Public Works Contract;

5.4.6(a)(ii) The number of such Nonroad Vehicles that were powered by Ultra Low Sulfur Diesel Fuel;

5.4.6(a)(iii) The number of such Nonroad Vehicles that utilized the best available technology for reducing the emission of pollutants, including a breakdown by vehicle model and the type of technology;

5.4.6(a)(iv) The number of such Nonroad Vehicles that utilized such other authorized technology in accordance with Article 5.4.3, including a breakdown by vehicle model and the type of technology used for each such vehicle;

5.4.6(a)(v) The locations where such Nonroad Vehicles were used; and

5.4.6(a)(vi) Where a determination is in effect pursuant to Article 5.4.2(b) or 5.4.2(c), detailed information concerning the **Contractor's** efforts to obtain Ultra Low Sulfur Diesel Fuel or diesel fuel that has a sulfur content of no more than thirty parts per million (30 ppm).

5.4.6(b) The **Contractor** shall submit the information required by Article 5.4.6(a) at the completion of **Work** under the Public Works Contract and on a yearly basis no later than August 1 throughout the term of the Public Works Contract. The yearly report shall cover **Work** performed during the preceding fiscal year (July 1 - June 30).

5.5 Ultra Low Sulfur Diesel Fuel. In accordance with the Coordinated Construction Act for Lower Manhattan, as amended:

5.5.1 Definitions. For purposes of this Article 5.5, the following definitions apply:

5.5.1(a) "Lower Manhattan" means the area to the south of and within the following lines: a line beginning at a point where the United States pierhead line in the Hudson River as it exists now or may be extended would intersect with the southerly line of West Houston Street in the Borough of Manhattan extended, thence easterly along the southerly side of West Houston Street to the southerly side of Houston Street, thence easterly along the southerly side of Houston Street to the southerly side of East Houston Street, thence northeasterly along the southerly side of East Houston Street to the point where it would intersect with the United States pierhead line in the East River as it exists now or may be extended, including tax lots within or immediately adjacent thereto.

5.5.1(b) "Lower Manhattan Redevelopment Project" means any project in Lower Manhattan that is funded in whole or in part with federal or State funding, or any project intended to improve transportation between Lower Manhattan and the two air terminals in the **City** known as LaGuardia Airport and John F. Kennedy International Airport, or between Lower Manhattan and the air terminal in Newark known as Newark Liberty International Airport, and that is funded in whole or in part with federal funding.

5.5.1(c) "Nonroad Engine" means an internal combustion engine (including the fuel system) that is not used in a Motor Vehicle or a vehicle used solely for competition, or that is not subject to standards promulgated under Section 7411 or Section 7521 of Title 42 of the United States Code, except that this term shall apply to internal combustion engines used to power generators, compressors or similar equipment used in any construction program or project.

5.5.1(d) "Nonroad Vehicle" means a vehicle that is powered by a Nonroad Engine, fifty (50) horsepower (HP) and greater, and that is not a Motor Vehicle or a vehicle used solely for competition, which shall include, but not be limited to, excavators, backhoes, cranes, compressors, generators, bulldozers, and similar equipment, except that this terms shall not apply to horticultural maintenance vehicles used for landscaping purposes that are powered by a Nonroad Engine of sixty-five (65) HP or less and that are not used in any construction program or project.

5.5.1(e) "Ultra Low Sulfur Diesel Fuel" means diesel fuel that has a sulfur content of no more than fifteen parts per million (15 ppm).

5.5.2 Requirements. **Contractors** and **Subcontractors** are required to use only Ultra Low Sulfur Diesel Fuel to power the diesel-powered Nonroad Vehicles with engine HP rating of fifty (50) HP and above used on a Lower Manhattan Redevelopment Project and, where practicable, to reduce the emission of pollutants by retrofitting such Nonroad Vehicles with oxidation catalysts, particulate filters, or technology that achieves lowest particulate matter emissions.

5.6 Pesticides. In accordance with Section 17-1209 of the Administrative Code, to the extent that the **Contractor** or any **Subcontractor** applies pesticides to any property owned or leased by the **City**, the **Contractor,** and any **Subcontractor** shall comply with Chapter 12 of the Administrative Code.

5.7 Waste Treatment, Storage, and Disposal Facilities and Transporters. In connection with the **Work**, the **Contractor** and any **Subcontractor** shall use only those waste treatment, storage, and disposal facilities and waste transporters that possess the requisite license, permit or other governmental approval necessary to treat, store, dispose, or transport the waste, materials or hazardous substances.

5.8 Environmentally Preferable Purchasing. The **Contractor** shall ensure that products purchased or leased by the **Contractor** or any **Subcontractor** for the **Work** that are not specified by the **City** or are submitted as equivalents to a product specified by the **City** comply with the requirements of the New York City Environmentally Preferable Purchasing Program contained in Chapter 11 of Title 43 of the RCNY, pursuant to Chapter 3 of Title 6 of the Administrative Code.

ARTICLE 6. INSPECTION

6.1 During the progress of the **Work** and up to the date of **Final Acceptance**, the **Contractor** shall at all times afford the representatives of the **City** every reasonable, safe, and proper facility for inspecting all **Work** done or being done at the **Site** and also for inspecting the manufacture or preparation of materials and equipment at the place of such manufacture or preparation.

6.2 The **Contractor's** obligation hereunder shall include the uncovering or taking down of finished **Work** and its restoration thereafter; provided, however, that the order to uncover, take down and restore shall be in writing, and further provided that if **Work** thus exposed proves satisfactory, and if the **Contractor** has complied with Article 6.1, such uncovering or taking down and restoration shall be

considered an item of **Extra Work** to be paid for in accordance with the provisions of Article 26. If the **Work** thus exposed proves unsatisfactory, the **City** has no obligation to compensate the **Contractor** for the uncovering, taking down or restoration.

6.3 Inspection and approval by the **Commissioner**, the **Engineer**, **Project Manager**, or **Resident Engineer**, of finished **Work** or of **Work** being performed, or of materials and equipment at the place of manufacture or preparation, shall not relieve the **Contractor** of its obligation to perform the **Work** in strict accordance with the **Contract**. Finished or unfinished **Work** not found to be in strict accordance with the **Contract** shall be replaced as directed by the **Engineer**, even though such **Work** may have been previously approved and paid for. Such corrective **Work** is **Contract Work** and shall not be deemed **Extra Work**.

6.4 Rejected **Work** and materials shall be promptly taken down and removed from the **Site**, which must at all times be kept in a reasonably clean and neat condition.

ARTICLE 7. PROTECTION OF WORK AND OF PERSONS AND PROPERTY; NOTICES AND INDEMNIFICATION

7.1 During the performance of the **Work** and up to the date of **Final Acceptance**, the **Contractor** shall be under an absolute obligation to protect the finished and unfinished **Work** against any damage, loss, injury, theft and/or vandalism and in the event of such damage, loss, injury, theft and/or vandalism, it shall promptly replace and/or repair such **Work** at the **Contractor's** sole cost and expense, as directed by the **Resident Engineer**. The obligation to deliver finished **Work** in strict accordance with the **Contract** prior to **Final Acceptance** shall be absolute and shall not be affected by the **Resident Engineer's** approval of, or failure to prohibit, the **Means and Methods of Construction** used by the **Contractor**.

7.2 During the performance of the **Work** and up to the date of **Final Acceptance**, the **Contractor** shall take all reasonable precautions to protect all persons and the property of the **City** and of others from damage, loss or injury resulting from the **Contractor's**, and/or its **Subcontractors'** operations under this **Contract.** The **Contractor's** obligation to protect shall include the duty to provide, place or replace, and adequately maintain at or about the **Site** suitable and sufficient protection such as lights, barricades, and enclosures.

7.3 The **Contractor** shall comply with the notification requirements set forth below in the event of any loss, damage or injury to **Work**, persons or property, or any accidents arising out of the operations of the **Contractor** and/or its **Subcontractors** under this **Contract**.

7.3.1 The **Contractor** shall make a full and complete report in writing to the **Resident Engineer** within three (3) **Days** after the occurrence.

7.3.2 The **Contractor** shall also send written notice of any such event to all insurance carriers that issued potentially responsive policies (including commercial general liability insurance carriers for events relating to the **Contractor**'s own employees) no later than twenty (20) days after such event and again no later than twenty (20) days after the initiation of any claim and/or action resulting therefrom. Such notice shall contain the following information: the number of the insurance policy, the name of the Named Insured, the date and location of the incident, and the identity of the persons injured or property damaged. For any policy on which the **City** and/or the **Engineer**, **Architect**, or **Project Manager** are Additional Insureds, such notice shall expressly specify that "this notice is

being given on behalf of the City of New York as Additional Insured, such other Additional Insureds, as well as the Named Insured."

7.3.2(a) Whenever such notice is sent under a policy on which the **City** is an Additional Insured, the **Contractor** shall provide copies of the notice to the **Comptroller,** the **Commissioner** and the **City** Corporation Counsel. The copy to the **Comptroller** shall be sent to the Insurance Unit, NYC Comptroller's Office, 1 Centre Street – Room 1222, New York, New York, 10007. The copy to the **Commissioner** shall be sent to the address set forth in Schedule A of the General Conditions. The copy to the **City** Corporation Counsel shall be sent to Insurance Claims Specialist, Affirmative Litigation Division, New York City Law Department, 100 Church Street, New York, New York 10007.

7.3.2(b) If the **Contractor** fails to provide any of the foregoing notices to any appropriate insurance carrier(s) in a timely and complete manner, the **Contractor** shall indemnify the **City** for all losses, judgments, settlements, and expenses, including reasonable attorneys' fees, arising from an insurer's disclaimer of coverage citing late notice by or on behalf of the **City**.

7.4 To the fullest extent permitted by law, the **Contractor** shall defend, indemnify, and hold the **City**, its employees, and officials (the "Indemnitees") harmless against any and all claims (including but not limited to claims asserted by any employee of the **Contractor** and/or its **Subcontractors**) and costs and expenses of whatever kind (including but not limited to payment or reimbursement of attorneys' fees and disbursements) allegedly arising out of or in any way related to the operations of the **Contractor** and/or its **Subcontractors** in the performance of this **Contract** or from the **Contractor's** and/or its **Subcontractors'** failure to comply with any of the provisions of this **Contract** or of the **Law**. Such costs and expenses shall include all those incurred in defending the underlying claim and those incurred in connection with the enforcement of this Article 7.4 by way of cross-claim, third-party claim, declaratory action or otherwise. The parties expressly agree that the indemnification obligation hereunder contemplates (1) full indemnity in the event of liability imposed against the Indemnitees without negligence and solely by reason of statute, operation of **Law** or otherwise; and (2) partial indemnity in the event of any actual negligence on the part of the Indemnitees either causing or contributing to the underlying claim (in which case, indemnification will be limited to any liability imposed over and above that percentage attributable to actual fault whether by statute, by operation of **Law**, or otherwise). Where partial indemnity is provided hereunder, all costs and expenses shall be indemnified on a pro rata basis.

7.4.1 Indemnification under Article 7.4 or any other provision of the **Contract** shall operate whether or not **Contractor** or its **Subcontractors** have placed and maintained the insurance specified under Article 22.

7.5 The provisions of this Article 7 shall not be deemed to create any new right of action in favor of third parties against the **Contractor** or the **City**.

CHAPTER III: TIME PROVISIONS

ARTICLE 8. COMMENCEMENT AND PROSECUTION OF THE WORK

8.1 The **Contractor** shall commence the **Work** on the date specified in the **Notice to Proceed** or the **Order to Work**. The time for performance of the **Work** under the **Contract** shall be computed from

the date specified in the **Notice to Proceed** or the **Order to Work. TIME BEING OF THE ESSENCE** to the **City**, the **Contractor** shall thereafter prosecute the **Work** diligently, using such **Means and Methods of Construction** as are in accord with Article 4 herein and as will assure its completion not later than the date specified in this Contract, or on the date to which the time for completion may be extended.

ARTICLE 9. PROGRESS SCHEDULES

9.1 To enable the **Work** to be performed in an orderly and expeditious manner, the **Contractor**, within fifteen (15) **Days** after the **Notice to Proceed** or **Order to Work**, unless otherwise directed by the **Engineer**, shall submit to the **Engineer** a proposed progress schedule based on the Critical Path Method in the form of a bar graph or in such other form as specified by the **Engineer**, and monthly cash flow requirements, showing:

9.1.1 The anticipated time of commencement and completion of each of the various operations to be performed under this **Contract**; and

9.1.2 The sequence and interrelation of each of these operations with the others and with those of other related contracts; and

9.1.3 The estimated time required for fabrication or delivery, or both, of all materials and equipment required for the **Work**, including the anticipated time for obtaining required approvals pursuant to Article 10; and

9.1.4 The estimated amount in dollars the **Contractor** will claim on a monthly basis.

9.2 The proposed schedule shall be revised as directed by the **Engineer**, until finally approved by the **Engineer**, and after such approval, subject to the provisions of Article 11, shall be strictly adhered to by the **Contractor**.

9.3 If the **Contractor** shall fail to adhere to the approved progress schedule, or to the schedule as revised pursuant to Article 11, it shall promptly adopt such other or additional **Means and Methods of Construction**, at its sole cost and expense, as will make up for the time lost and will assure completion in accordance with the approved progress schedule. The approval by the **City** of a progress schedule which is shorter than the time allotted under the **Contract** shall not create any liability for the **City** if the approved progress schedule is not met.

9.4 The **Contractor** will not receive any payments until the proposed progress schedule is submitted.

ARTICLE 10. REQUESTS FOR INFORMATION OR APPROVAL

10.1 From time to time as the **Work** progresses and in the sequence indicated by the approved progress schedule, the **Contractor** shall submit to the **Engineer** a specific request in writing for each item of information or approval required by the **Contractor**. These requests shall state the latest date upon which the information or approval is actually required by the **Contractor**, and shall be submitted in a reasonable time in advance thereof to provide the **Engineer** a sufficient time to act upon such submissions, or any necessary re-submissions thereof.

10.2 The **Contractor** shall not have any right to an extension of time on account of delays due to the **Contractor's** failure to submit requests for the required information or the required approval in accordance with the above requirements.

ARTICLE 11. NOTICE OF CONDITIONS CAUSING DELAY AND DOCUMENTATION OF DAMAGES CAUSED BY DELAY

11.1 After the commencement of any condition which is causing or may cause a delay in completion of the **Work**, including conditions for which the **Contractor** may be entitled to an extension of time, the following notifications and submittals are required:

11.1.1 Within fifteen (15) **Days** after the **Contractor** becomes aware or reasonably should be aware of each such condition, the **Contractor** must notify the **Resident Engineer** or **Engineer**, as directed by the **Commissioner**, in writing of the existence, nature and effect of such condition upon the approved progress schedule and the **Work**, and must state why and in what respects, if any, the condition is causing or may cause a delay. Such notice shall include a description of the construction activities that are or could be affected by the condition and may include any recommendations the **Contractor** may have to address the delay condition and any activities the **Contractor** may take to avoid or minimize the delay.

11.1.2 If the **Contractor** shall claim to be sustaining damages for delay as provided for in this Article 11,within forty-five (45) **Days** from the time such damages are first incurred for each such condition, the **Contractor** shall submit to the **Commissioner** a verified written statement of the details and estimates of the amounts of such damages, including categories of expected damages and projected monthly costs, together with documentary evidence of such damages as the **Contractor** may have at the time of submission ("statement of delay damages"), as further detailed in Article 11.6. The **Contractor** may submit the above statement within such additional time as may be granted by the **Commissioner** in writing upon written request therefor.

11.1.3 Articles 11.1.1 and 11.1.2 do not relieve the **Contractor** of its obligation to comply with the provisions of Article 44.

11.2 Failure of the **Contractor** to strictly comply with the requirements of Article 11.1.1 may, in the discretion of the **Commissioner**, be deemed sufficient cause to deny any extension of time on account of delay arising out of such condition. Failure of the **Contractor** to strictly comply with the requirements of both Articles 11.1.1 and 11.1.2 shall be deemed a conclusive waiver by the **Contractor** of any and all claims for damages for delay arising from such condition and no right to recover on such claims shall exist.

11.3 When appropriate and directed by the **Engineer**, the progress schedule shall be revised by the **Contractor** until finally approved by the **Engineer**. The revised progress schedule must be strictly adhered to by the **Contractor**.

11.4 Compensable Delays

11.4.1 The **Contractor** agrees to make claim only for additional costs attributable to delay in the performance of this **Contract** necessarily extending the time for completion of the **Work** or resulting from acceleration directed by the **Commissioner** and required to maintain the progress schedule, occasioned solely by any act or omission to act of the **City** listed below. The **Contractor** also agrees that delay from any other cause shall be

compensated, if at all, solely by an extension of time to complete the performance of the **Work**.

11.4.1.1 The failure of the **City** to take reasonable measures to coordinate and progress the **Work** to the extent required by the **Contract**, except that the City shall not be responsible for the **Contractor's** obligation to coordinate and progress the **Work** of its **Subcontractors**.

11.4.1.2 Unreasonable delays attributable to the review of shop drawings, the issuance of change orders, or the cumulative impact of change orders that were not brought about by any act or omission of the **Contractor**.

11.4.1.3 The unavailability of the **Site** caused by acts or omissions of the **City**..

11.4.1.4 The issuance by the **Engineer** of a stop work order that was not brought about through any act or omission of the **Contractor**.

11.4.1.5 Differing site conditions or environmental hazards that were neither known nor reasonably ascertainable on a pre-bid inspection of the **Site** or review of the bid documents or other publicly available sources, and that are not ordinarily encountered in the **Project**'s geographical area or neighborhood or in the type of **Work** to be performed.

11.4.1.6 Delays caused by the **City's** bad faith or its willful, malicious, or grossly negligent conduct;

11.4.1.7 Delays not contemplated by the parties;

11.4.1.8 Delays so unreasonable that they constitute an intentional abandonment of the **Contract** by the **City**; and

11.4.1.9 Delays resulting from the **City's** breach of a fundamental obligation of the **Contract**.

11.4.2 No claim may be made for any alleged delay in **Substantial Completion** of the **Work** if the **Work** will be or is substantially completed by the date of **Substantial Completion** provided for in Schedule A unless acceleration has been directed by the **Commissioner** to meet the date of **Substantial Completion** set forth in Schedule A, or unless there is a provision in the **Contract** providing for additional compensation for early completion.

11.4.3 The provisions of this Article 11 apply only to claims for additional costs attributable to delay and do not preclude determinations by the **Commissioner** allowing reimbursements for additional costs for **Extra Work** pursuant to Articles 25 and 26 of this **Contract**. To the extent that any cost attributable to delay is reimbursed as part of a change order, no additional claim for compensation under this Article 11 shall be allowed.

11.5 Non-Compensable Delays. The **Contractor** agrees to make no claim for, and is deemed to have included in its bid prices for the various items of the **Contract**, the extra/additional costs attributable to any delays caused by or attributable to the items set forth below. For such items, the **Contractor** shall be compensated, if at all, solely by an extension of time to complete the performance of the **Work**, in accordance with the provisions of Article 13. Such extensions of time will be granted, if at all, pursuant to the grounds set forth in Article 13.3.

11.5.1 The acts or omissions of any third parties, including but not limited to **Other Contractors**, public/ governmental bodies (other than **City Agencies**), utilities or private enterprises, who are disclosed in the **Contract Documents** or are ordinarily encountered or generally recognized as related to the **Work**;

11.5.2 Any situation which was within the contemplation of the parties at the time of entering into the **Contract**, including any delay indicated or disclosed in the **Contract Documents** or that would be generally recognized by a reasonably prudent contractor as related to the nature of the **Work**, and/or the existence of any facility or appurtenance owned, operated or maintained by any third party, as indicated or disclosed in the **Contract Documents** or ordinarily encountered or generally recognized as related to the nature of the **Work**;

11.5.3 Restraining orders, injunctions or judgments issued by a court which were caused by a Contractor's submission, action or inaction or by a Contractor's **Means and Methods of Construction**, or by third parties, unless such order, injunction or judgment was the result of an act or omission by the **City**;

11.5.4 Any labor boycott, strike, picketing, lockout or similar situation;

11.5.5 Any shortages of supplies or materials, or unavailability of equipment, required by the **Contract Work**;

11.5.6 Climatic conditions, storms, floods, droughts, tidal waves, fires, hurricanes, earthquakes, landslides or other catastrophes or acts of God, or acts of war or of the public enemy or terrorist acts, including the **City's** reasonable responses thereto; and

11.5.7 **Extra Work** which does not significantly affect the overall completion of the **Contract**, reasonable delays in the review or issuance of change orders or field orders and/or in shop drawing reviews or approvals.

11.6 Required Content of Submission of Statement of Delay Damages

11.6.1 In the verified written statement of delay damages required by Article 11.1.2, the following information shall be provided by the **Contractor**:

11.6.1.1 For each delay, the start and end dates of the claimed periods of delay and, in addition, a description of the operations that were delayed, an explanation of how they were delayed, and the reasons for the delay, including identifying the applicable act or omission of the City listed in Article 11.4.

11.6.1.2 A detailed factual statement of the claim providing all necessary dates, locations and items of **Work** affected by the claim.

11.6.1.3 The estimated amount of additional compensation sought and a breakdown of that amount into categories as described in Article 11.7.

11.6.1.4 Any additional information requested by the **Commissioner**.

11.7 Recoverable Costs

11.7.1 Delay damages may be recoverable for the following costs actually and necessarily incurred in the performance of the **Work**:

11.7.1.1 Direct labor, including payroll taxes (subject to statutory wage caps) and supplemental benefits, based on time and materials records;

11.7.1.2 Necessary materials (including transportation to the **Site**), based on time and material records;

11.7.1.3 Reasonable rental value of necessary plant and equipment other than small tools, plus fuel/energy costs according to the applicable formula set forth in Articles 26.2.4 and/or 26.2.8, based on time and material records;

11.7.1.4 Additional insurance and bond costs;

11.7.1.5 Extended **Site** overhead, field office rental, salaries of field office staff, on-site project managers and superintendents, field office staff vehicles, **Project**-specific storage, field office utilities and telephone, and field office consumables;

11.7.1.6 Labor escalation costs based on actual costs;

11.7.1.7 Materials and equipment escalation costs based on applicable industry indices unless documentation of actual increased cost is provided;

11.7.1.8 Additional material and equipment storage costs based on actual documented costs and additional costs necessitated by extended manufacturer warranty periods; and

11.7.1.9 Extended home office overhead calculated based on the following formula:

(1) Subtract from the original **Contract** amount the amount earned by original contractual **Substantial Completion** date (not including change orders);

(2) Remove 15% overhead and profit from the calculation in item (1) by dividing the results of item (1) by 1.15;

(3) Multiply the result of item (2) by 7.25% for the total home office overhead;

(4) Multiply the result of item (3) by 7.25% for the total profit; and

(5) The total extended home office overhead will be the total of items (3) and (4).

11.7.2 Recoverable Subcontractor Costs. When the **Work** is performed by a **Subcontractor**, the **Contractor** may be paid the actual and necessary costs of such subcontracted **Work** as outlined above in Articles 11.7.1.1 through 11.7.1.8, and an additional overhead of 5% of the costs outlined in Articles 11.7.1.1 through 11.7.1.3.

11.7.3 Non-Recoverable Costs. The parties agree that the **City** will have no liability for the following items and the **Contractor** agrees it shall make no claim for the following items:

11.7.3.1 Profit, or loss of anticipated or unanticipated profit, except as provided in Article 11.7.1.9;

11.7.3.2 Consequential damages, including, but not limited to, construction or bridge loans or interest paid on such loans, loss of bonding capacity, bidding opportunities, or interest in investment, or any resulting insolvency;

11.7.3.3 Indirect costs or expenses of any nature except those included in Article 11.7.1;

11.7.3.4 Direct or indirect costs attributable to performance of **Work** where the **Contractor**, because of situations or conditions within its control, has not progressed the **Work** in a satisfactory manner; and

11.7.3.5 Attorneys' fees and dispute and claims preparation expenses.

11.8 Any claims for delay under this Article 11 are not subject to the jurisdiction of the Contract Dispute Resolution Board pursuant to the dispute resolution process set forth in Article 27.

11.9 Any compensation provided to the **Contractor** in accordance with this Article 11 will be made pursuant to a claim filed with the **Comptroller**. Nothing in this Article 11 extends the time for the **Contractor** to file an action with respect to a claim within six months after **Substantial Completion** pursuant to Article 56.

ARTICLE 12. COORDINATION WITH OTHER CONTRACTORS

12.1 During the progress of the **Work**, **Other Contractors** may be engaged in performing other work or may be awarded other contracts for additional work on this **Project**. In that event, the **Contractor** shall coordinate the **Work** to be done hereunder with the work of such **Other Contractors** and the **Contractor** shall fully cooperate with such **Other Contractors** and carefully fit its own **Work** to that provided under other contracts as may be directed by the **Engineer**. The **Contractor** shall not commit or permit any act which will interfere with the performance of work by any **Other Contractors**.

12.2 If the **Engineer** determines that the **Contractor** is failing to coordinate its **Work** with the work of **Other Contractors** as the **Engineer** has directed, then the **Commissioner** shall have the right to withhold any payments otherwise due hereunder until the **Contractor** completely complies with the **Engineer's** directions.

12.3 The **Contractor** shall notify the **Engineer** in writing if any **Other Contractor** on this **Project** is failing to coordinate its work with the **Work** of this **Contract**. If the **Engineer** finds such charges to be true, the **Engineer** shall promptly issue such directions to the **Other Contractor** with respect thereto as the situation may require. The **City** shall not, however, be liable for any damages suffered by any **Other Contractor's** failure to coordinate its work with the **Work** of this **Contract** or by reason of the **Other Contractor's** failure to promptly comply with the directions so issued by the **Engineer**, or by reason of any **Other Contractor's** default in performance, it being understood that the **City** does not guarantee the responsibility or continued efficiency of any contractor. The **Contractor** agrees to make no claim against the **City** for any damages relating to or arising out of any directions issued by the **Engineer** pursuant to this Article 12 (including but not limited to the failure of any **Other Contractor** to comply or promptly comply with such directions), or the failure of any **Other Contractor** to coordinate its work, or the default in performance of any **Other Contractor**.

12.4 The **Contractor** shall indemnify and hold the **City** harmless from any and all claims or judgments for damages and from costs and expenses to which the **City** may be subjected or which it may suffer or incur by reason of the **Contractor's** failure to comply with the **Engineer's** directions promptly; and the **Comptroller** shall have the right to exercise the powers reserved in Article 23 with respect to any claims which may be made for damages due to the **Contractor's** failure to comply with the **Engineer's** directions promptly. Insofar as the facts and **Law** relating to any claim would preclude the **City** from being completely indemnified by the **Contractor**, the **City** shall be partially indemnified by the **Contractor** to the fullest extent provided by **Law**.

12.5 Should the **Contractor** sustain any damage through any act or omission of any **Other Contractor** having a contract with the **City** for the performance of work upon the **Site** or of work which may be necessary to be performed for the proper prosecution of the **Work** to be performed hereunder, or through any act or omission of a subcontractor of such **Other Contractor**, the **Contractor** shall have no claim against the **City** for such damage, but shall have a right to recover such damage from the **Other**

Contractor under the provision similar to the following provisions which apply to this **Contract** and have been or will be inserted in the contracts with such **Other Contractors**:

12.5.1 Should any **Other Contractor** having or who shall hereafter have a contract with the **City** for the performance of work upon the **Site** sustain any damage through any act or omission of the **Contractor** hereunder or through any act or omission of any **Subcontractor** of the **Contractor**, the **Contractor** agrees to reimburse such **Other Contractor** for all such damages and to defend at its own expense any action based upon such claim and if any judgment or claim (even if the allegations of the action are without merit) against the **City** shall be allowed the **Contractor** shall pay or satisfy such judgment or claim and pay all costs and expenses in connection therewith and agrees to indemnify and hold the **City** harmless from all such claims. Insofar as the facts and **Law** relating to any claim would preclude the **City** from being completely indemnified by the **Contractor**, the **City** shall be partially indemnified by the **Contractor** to the fullest extent provided by **Law**.

12.6 The **City's** right to indemnification hereunder shall in no way be diminished, waived or discharged by its recourse to assessment of liquidated damages as provided in Article 15, or by the exercise of any other remedy provided for by **Contract** or by **Law**.

ARTICLE 13. EXTENSION OF TIME FOR PERFORMANCE

13.1 If performance by the **Contractor** is delayed for a reason set forth in Article 13.3, the **Contractor** may be allowed a reasonable extension of time in conformance with this Article 13 and the **PPB** Rules.

13.2 Any extension of time may be granted only by the **ACCO** or by the Board for the Extension of Time (hereafter "Board") (as set forth below) upon written application by the **Contractor**.

13.3 Grounds for Extension: If such application is made, the **Contractor** shall be entitled to an extension of time for delay in completion of the **Work** caused solely:

13.3.1 By the acts or omissions of the **City**, its officials, agents or employees; or

13.3.2 By the act or omissions of **Other Contractors** on this **Project**; or

13.3.3 By supervening conditions entirely beyond the control of either party hereto (such as, but not limited to, acts of God or the public enemy, excessive inclement weather, war or other national emergency making performance temporarily impossible or illegal, or strikes or labor disputes not brought about by any act or omission of the **Contractor**).

13.3.4 The **Contractor** shall, however, be entitled to an extension of time for such causes only for the number of **Days** of delay which the **ACCO** or the Board may determine to be due solely to such causes, and then only if the **Contractor** shall have strictly complied with all of the requirements of Articles 9 and 10.

13.4 The **Contractor** shall not be entitled to receive a separate extension of time for each of several causes of delay operating concurrently, but, if at all, only for the actual period of delay in completion of the **Work** as determined by the **ACCO** or the Board, irrespective of the number of causes contributing to produce such delay. If one of several causes of delay operating concurrently results from any act, fault or omission of the **Contractor** or of its **Subcontractors** or **Materialmen**, and would of itself (irrespective

of the concurrent causes) have delayed the **Work**, no extension of time will be allowed for the period of delay resulting from such act, fault or omission.

13.5 The determination made by the **ACCO** or the Board on an application for an extension of time shall be binding and conclusive on the **Contractor**.

13.6 The **ACCO** or the Board acting entirely within their discretion may grant an application for an extension of time for causes of delay other than those herein referred.

13.7 Permitting the **Contractor** to continue with the **Work** after the time fixed for its completion has expired, or after the time to which such completion may have been extended has expired, or the making of any payment to the **Contractor** after such time, shall in no way operate as a waiver on the part of the **City** of any of its rights under this **Contract**.

13.8 Application for Extension of Time:

13.8.1 Before the **Contractor's** time extension request will be considered, the **Contractor** shall notify the **ACCO** of the condition which allegedly has caused or is causing the delay, and shall submit a written application to the **ACCO** identifying:

13.8.1(a) The **Contractor**; the registration number; and **Project** description;

13.8.1(b) Liquidated damage assessment rate, as specified in the **Contract**;

13.8.1(c) Original total bid price;

13.8.1(d) The original **Contract** start date and completion date;

13.8.1(e) Any previous time extensions granted (number and duration); and

13.8.1(f) The extension of time requested.

13.8.2 In addition, the application for extension of time shall set forth in detail:

13.8.2(a) The nature of each alleged cause of delay in completing the **Work**;

13.8.2(b) The date upon which each such cause of delay began and ended and the number of **Days** attributable to each such cause;

13.8.2(c) A statement that the **Contractor** waives all claims except for those delineated in the application, and the particulars of any claims which the **Contractor** does not agree to waive. For time extensions for **Substantial Completion** and final completion payments, the application shall include a detailed statement of the dollar amounts of each element of claim item reserved; and

13.8.2(d) A statement indicating the **Contractor's** understanding that the time extension is granted only for purposes of permitting continuation of **Contract** performance and payment for **Work** performed and that the **City** retains its right to conduct an investigation and assess liquidated damages as appropriate in the future.

13.9 Analysis and Approval of Time Extensions:

13.9.1 For time extensions for partial payments, a written determination shall be made by the **ACCO** who may, for good and sufficient cause, extend the time for the performance of the **Contract** as follows:

13.9.1(a) If the **Work** is to be completed within six (6) months, the time for performance may be extended for sixty (60) **Days**;

13.9.1(b) If the **Work** is to be completed within less than one (1) year but more than six (6) months, an extension of ninety (90) **Days** may be granted;

13.9.1(c) If the **Contract** period exceeds one (1) year, besides the extension granted in Article 13.9.1(b), an additional thirty (30) **Days** may be granted for each multiple of six (6) months involved beyond the one (1) year period; or

13.9.1(d) If exceptional circumstances exist, the **ACCO** may extend the time for performance beyond the extensions in Articles 13.9.1(a), 13.9.1(b), and 13.9.1(c). In that event, the **ACCO** shall file with the Mayor's Office of Contract Services a written explanation of the exceptional circumstances.

13.9.2 For extensions of time for **Substantial Completion** and final completion payments, the **Engineer**, in consultation with the **ACCO**, shall prepare a written analysis of the delay (including a preliminary determination of the causes of delay, the beginning and end dates for each such cause of delay, and whether the delays are excusable under the terms of this **Contract**). The report shall be subject to review by and approval of the Board, which shall have authority to question its analysis and determinations and request additional facts or documentation. The report as reviewed and made final by the Board shall be made a part of the **Agency** contract file. Neither the report itself nor anything contained therein shall operate as a waiver or release of any claim the **City** may have against the **Contractor** for either actual or liquidated damages.

13.9.3 Approval Mechanism for Time Extensions for **Substantial Completion** or Final Completion Payments: An extension shall be granted only with the approval of the Board which is comprised of the **ACCO** of the **Agency**, the **City** Corporation Counsel, and the **Comptroller**, or their authorized representatives.

13.9.4 Neither the granting of any application for an extension of time to the **Contractor** or any **Other Contractor** on this **Project** nor the papers, records or reports related to any application for or grant of an extension of time or determination related thereto shall be referred to or offered in evidence by the **Contractor** or its attorneys in any action or proceeding.

13.10 No Damage for Delay: The **Contractor** agrees to make no claim for damages for delay in the performance of this **Contract** occasioned by any act or omission to act of the **City** or any of its representatives, except as provided for in Article 11.

ARTICLE 14. COMPLETION AND FINAL ACCEPTANCE OF THE WORK

14.1 Date for **Substantial Completion**: The **Contractor** shall substantially complete the **Work** within the time fixed in Schedule A of the General Conditions, or within the time to which such **Substantial Completion** may be extended.

14.2 Determining the Date of **Substantial Completion**: The **Work** will be deemed to be substantially complete when the two conditions set forth below have been met.

14.2.1 Inspection: The **Engineer** or **Resident Engineer**, as applicable, has inspected the **Work** and has made a written determination that it is substantially complete.

14.2.2 Approval of **Final Approved Punch List** and Date for **Final Acceptance**: Following inspection of the **Work**, the **Engineer/Resident Engineer** shall furnish the **Contractor** with a final punch list, specifying all items of **Work** to be completed and proposing dates for the completion of each specified item of **Work**. The **Contractor** shall then submit in writing to the **Engineer/Resident Engineer** within ten (10) **Days** of the **Engineer/Resident Engineer** furnishing the final punch list either acceptance of the dates or proposed alternative dates for the completion of each specified item of **Work**. If the **Contractor** neither accepts the dates nor proposes alternative dates within ten (10) **Days**, the schedule proposed by the **Engineer/Resident Engineer** shall be deemed accepted. If the **Contractor** proposes alternative dates, then, within a reasonable time after receipt, the **Engineer/Resident Engineer**, in a written notification to the **Contractor**, shall approve the **Contractor's** completion dates or, if they are unable to agree, the **Engineer/Resident Engineer** shall establish dates for the completion of each item of **Work**. The latest completion date specified shall be the date for **Final Acceptance** of the **Work**.

14.3 Date of **Substantial Completion**. The date of approval of the **Final Approved Punch List**, shall be the date of **Substantial Completion**. The date of approval of the **Final Approved Punch List** shall be either (a) if the **Contractor** approves the final punch list and proposed dates for completion furnished by the **Engineer/Resident Engineer**, the date of the **Contractor**'s approval; or (b) if the **Contractor** neither accepts the dates nor proposes alternative dates, ten (10) **Days** after the **Engineer/Resident Engineer** furnishes the **Contractor** with a final punch list and proposed dates for completion; or (c) if the **Contractor** proposes alternative dates, the date that the **Engineer/Resident Engineer** sends written notification to the **Contractor** either approving the **Contractor**'s proposed alternative dates or establishing dates for the completion for each item of **Work**.

14.4 Determining the Date of **Final Acceptance**: The **Work** will be accepted as final and complete as of the date of the **Engineer's/Resident Engineer**'s inspection if, upon such inspection, the **Engineer/Resident Engineer** finds that all items on the **Final Approved Punch List** are complete and no further **Work** remains to be done. The **Commissioner** will then issue a written determination of **Final Acceptance**.

14.5 Request for Inspection: Inspection of the **Work** by the **Engineer/Resident Engineer** for the purpose of **Substantial Completion** or **Final Acceptance** shall be made within fourteen (14) **Days** after receipt of the **Contractor's** written request therefor.

14.6 Request for Re-inspection: If upon inspection for the purpose of **Substantial Completion** or **Final Acceptance**, the **Engineer/Resident Engineer** determines that there are items of **Work** still to be performed, the **Contractor** shall promptly perform them and then request a re-inspection. If upon re-inspection, the **Engineer/Resident Engineer** determines that the **Work** is substantially complete or finally accepted, the date of such re-inspection shall be the date of **Substantial Completion** or **Final Acceptance**. Re-inspection by the **Engineer/Resident Engineer** shall be made within ten (10) **Days** after receipt of the **Contractor's** written request therefor.

14.7 Initiation of Inspection by the **Engineer/Resident Engineer**: If the **Contractor** does not request inspection or re-inspection of the **Work** for the purpose of **Substantial Completion** or **Final Acceptance**, the **Engineer/Resident Engineer** may initiate such inspection or re-inspection.

ARTICLE 15. LIQUIDATED DAMAGES

15.1 In the event the **Contractor** fails to substantially complete the **Work** within the time fixed for such **Substantial Completion** in Schedule A of the General Conditions, plus authorized time extensions, or if the **Contractor**, in the sole determination of the **Commissioner**, has abandoned the **Work**, the **Contractor** shall pay to the **City** the sum fixed in Schedule A of the General Conditions, for each and every **Day** that the time consumed in substantially completing the **Work** exceeds the time allowed therefor; which said sum, in view of the difficulty of accurately ascertaining the loss which the **City** will suffer by reason of delay in the **Substantial Completion** of the **Work** hereunder, is hereby fixed and agreed as the liquidated damages that the **City** will suffer by reason of such delay, and not as a penalty. This Article 15 shall also apply to the **Contractor** whether or not the **Contractor** is defaulted pursuant to Chapter X of this **Contract**. Neither the failure to assess liquidated damages nor the granting of any time extension shall operate as a waiver or release of any claim the **City** may have against the **Contractor** for either actual or liquidated damages.

15.2 Liquidated damages received hereunder are not intended to be nor shall they be treated as either a partial or full waiver or discharge of the **City's** right to indemnification, or the **Contractor's** obligation to indemnify the **City**, or to any other remedy provided for in this **Contract** or by **Law**.

15.3 The **Commissioner** may deduct and retain out of the monies which may become due hereunder, the amount of any such liquidated damages; and in case the amount which may become due hereunder shall be less than the amount of liquidated damages suffered by the **City**, the **Contractor** shall be liable to pay the difference.

ARTICLE 16. OCCUPATION OR USE PRIOR TO COMPLETION

16.1 Unless otherwise provided for in the **Specifications**, the **Commissioner** may take over, use, occupy or operate any part of the **Work** at any time prior to **Final Acceptance**, upon written notification to the **Contractor**. The **Engineer** or **Resident Engineer**, as applicable, shall inspect the part of the **Work** to be taken over, used, occupied, or operated, and will furnish the **Contractor** with a written statement of the **Work**, if any, which remains to be performed on such part. The **Contractor** shall not object to, nor interfere with, the **Commissioner's** decision to exercise the rights granted by Article 16. In the event the **Commissioner** takes over, uses, occupies, or operates any part of the **Work:**

16.1.1 the **Engineer/Resident Engineer** shall issue a written determination of **Substantial Completion** with respect to such part of the **Work**;

16.1.2 the **Contractor** shall be relieved of its absolute obligation to protect such part of the unfinished **Work** in accordance with Article 7;

16.1.3 the **Contractor's** guarantee on such part of the **Work** shall begin on the date of such use by the **City**; and;

16.1.4 the **Contractor** shall be entitled to a return of so much of the amount retained in accordance with Article 21 as it relates to such part of the **Work**, except so much thereof as may be retained under Articles 24 and 44.

CHAPTER IV: SUBCONTRACTS AND ASSIGNMENTS

ARTICLE 17. SUBCONTRACTS

17.1 The **Contractor** shall not make subcontracts totaling an amount more than the percentage of the total **Contract** price fixed in Schedule A of the General Conditions, without prior written permission from the **Commissioner**. All subcontracts made by the **Contractor** shall be in writing. No **Work** may be performed by a **Subcontractor** prior to the **Contractor** entering into a written subcontract with the **Subcontractor** and complying with the provisions of this Article 17.

17.2 Before making any subcontracts, the **Contractor** shall submit a written statement to the **Commissioner** giving the name and address of the proposed **Subcontractor**; the portion of the **Work** and materials which it is to perform and furnish; the cost of the subcontract; the VENDEX questionnaire if required; the proposed subcontract if requested by the **Commissioner**; and any other information tending to prove that the proposed **Subcontractor** has the necessary facilities, skill, integrity, past experience, and financial resources to perform the **Work** in accordance with the terms and conditions of this **Contract**.

17.3 In addition to the requirements in Article 17.2, **Contractor** is required to list the **Subcontractor** in the web based Subcontractor Reporting System through the City's Payee Information Portal (PIP), available at www.nyc.gov/pip.[1] For each **Subcontractor** listed, **Contractor** is required to provide the following information: maximum contract value, description of **Subcontractor's** Work, start and end date of the subcontract and identification of the **Subcontractor**'s industry. Thereafter, **Contractor** will be required to report in the system the payments made to each **Subcontractor** within 30 days of making the payment. If any of the required information changes throughout the Term of the **Contract**, **Contractor** will be required to revise the information in the system.

Failure of the **Contractor** to list a **Subcontractor** and/or to report **Subcontractor** payments in a timely fashion may result in the **Commissioner** declaring the **Contractor** in default of the **Contract** and will subject **Contractor** to liquidated damages in the amount of $100 per day for each day that the **Contractor** fails to identify a **Subcontractor** along with the required information about the **Subcontractor** and/or fails to report payments to a **Subcontractor**, beyond the time frames set forth herein or in the notice from the **City**. Article 15 shall govern the issue of liquidated damages.

17.4 If an approved **Subcontractor** elects to subcontract any portion of its subcontract, the proposed sub-subcontract shall be submitted in the same manner as directed above.

17.5 The **Commissioner** will notify the **Contractor** in writing whether the proposed **Subcontractor** is approved. If the proposed **Subcontractor** is not approved, the **Contractor** may submit another proposed **Subcontractor** unless the **Contractor** decides to do the **Work**. No **Subcontractor** shall be permitted to enter or perform any work on the **Site** unless approved.

17.6 Before entering into any subcontract hereunder, the **Contractor** shall provide the proposed **Subcontractor** with a complete copy of this document and inform the proposed **Subcontractor** fully and completely of all provisions and requirements of this **Contract** relating either directly or indirectly to the **Work** to be performed and the materials to be furnished under such subcontract, and every such

[1] In order to use the new system, a PIP account will be required. Detailed instructions on creating a PIP account and using the new system are also available at www.nyc.gov/pip. Additional assistance with PIP may be obtained by emailing the Financial Information Services Agency Help Desk at pip@fisa.nyc.gov.

Subcontractor shall expressly stipulate that all labor performed and materials furnished by the **Subcontractor** shall strictly comply with the requirements of this **Contract**.

17.7 Documents given to a prospective **Subcontractor** for the purpose of soliciting the **Subcontractor's** bid shall include either a copy of the bid cover or a separate information sheet setting forth the **Project** name, the **Contract** number (if available), the **Agency** (as noted in Article 2.1.6), and the **Project's** location.

17.8 The **Commissioner's** approval of a **Subcontractor** shall not relieve the **Contractor** of any of its responsibilities, duties, and liabilities hereunder. The **Contractor** shall be solely responsible to the **City** for the acts or defaults of its **Subcontractor** and of such **Subcontractor's** officers, agents, and employees, each of whom shall, for this purpose, be deemed to be the agent or employee of the **Contractor** to the extent of its subcontract.

17.9 If the **Subcontractor** fails to maintain the necessary facilities, skill, integrity, past experience, and financial resources (other than due to the **Contractor's** failure to make payments where required) to perform the **Work** in accordance with the terms and conditions of this **Contract**, the **Contractor** shall promptly notify the **Commissioner** and replace such **Subcontractor** with a newly approved **Subcontractor** in accordance with this Article 17.

17.10 The **Contractor** shall be responsible for ensuring that all **Subcontractors** performing **Work** at the **Site** maintain all insurance required by **Law**.

17.11 The **Contractor** shall promptly, upon request, file with the **Engineer** a conformed copy of the subcontract and its cost. The subcontract shall provide the following:

17.11.1 Payment to **Subcontractors**: The agreement between the **Contractor** and its **Subcontractor** shall contain the same terms and conditions as to method of payment for **Work**, labor, and materials, and as to retained percentages, as are contained in this **Contract**.

17.11.2 Prevailing Rate of Wages: The agreement between the **Contractor** and its **Subcontractor** shall include the prevailing wage rates and supplemental benefits to be paid in accordance with Labor Law Section 220.

17.11.3 Section 6-123 of the Administrative Code: Pursuant to the requirements of Section 6-123 of the Administrative Code, every agreement between the **Contractor** and a **Subcontractor** in excess of fifty thousand ($50,000) dollars shall include a provision that the **Subcontractor** shall not engage in any unlawful discriminatory practice as defined in Title VIII of the Administrative Code (Section 8-101 *et seq.*).

17.11.4 All requirements required pursuant to federal and/or state grant agreement(s), if applicable to the **Work**.

17.12 The **Commissioner** may deduct from the amounts certified under this **Contract** to be due to the **Contractor**, the sum or sums due and owing from the **Contractor** to the **Subcontractors** according to the terms of the said subcontracts, and in case of dispute between the **Contractor** and its **Subcontractor**, or **Subcontractors**, as to the amount due and owing, the **Commissioner** may deduct and withhold from the amounts certified under this **Contract** to be due to the **Contractor** such sum or sums as may be claimed by such **Subcontractor**, or **Subcontractors**, in a sworn affidavit, to be due and owing until such time as such claim or claims shall have been finally resolved.

17.13 On contracts where performance bonds and payment bonds are executed, the **Contractor** shall include on each requisition for payment the following data: **Subcontractor's** name, value of the subcontract, total amount previously paid to **Subcontractor** for **Work** previously requisitioned, and the amount, including retainage, to be paid to the **Subcontractor** for **Work** included in the requisition.

17.14 On **Contracts** where performance bonds and payment bonds are not executed, the **Contractor** shall include with each requisition for payment submitted hereunder, a signed statement from each and every **Subcontractor** and/or **Materialman** for whom payment is requested in such requisition. Such signed statement shall be on the letterhead of the **Subcontractor** and/or **Materialman** for whom payment is requested and shall (i) verify that such **Subcontractor** and/or **Materialman** has been paid in full for all **Work** performed and/or material supplied to date, exclusive of any amount retained and any amount included on the current requisition, and (ii) state the total amount of retainage to date, exclusive of any amount retained on the current requisition.

ARTICLE 18. ASSIGNMENTS

18.1 The **Contractor** shall not assign, transfer, convey or otherwise dispose of this **Contract**, or the right to execute it, or the right, title or interest in or to it or any part thereof, or assign, by power of attorney or otherwise any of the monies due or to become due under this **Contract**, unless the previous written consent of the **Commissioner** shall first be obtained thereto, and the giving of any such consent to a particular assignment shall not dispense with the necessity of such consent to any further or other assignments.

18.2 Such assignment, transfer, conveyance or other disposition of this **Contract** shall not be valid until filed in the office of the **Commissioner** and the **Comptroller**, with the written consent of the **Commissioner** endorsed thereon or attached thereto.

18.3 Failure to obtain the previous written consent of the **Commissioner** to such an assignment, transfer, conveyance or other disposition, may result in the revocation and annulment of this **Contract**. The **City** shall thereupon be relieved and discharged from any further liability to the **Contractor**, its assignees, transferees or sublessees, who shall forfeit and lose all monies therefor earned under the **Contract**, except so much as may be required to pay the **Contractor's** employees.

18.4 The provisions of this clause shall not hinder, prevent, or affect an assignment by the **Contractor** for the benefit of its creditors made pursuant to the **Laws** of the State of New York.

18.5 This **Contract** may be assigned by the **City** to any corporation, agency or instrumentality having authority to accept such assignment.

CHAPTER V: CONTRACTOR'S SECURITY AND GUARANTEE

ARTICLE 19. SECURITY DEPOSIT

19.1 If performance and payment bonds are required, the **City** shall retain the bid security to ensure that the successful bidder executes the **Contract** and furnishes the required payment and performance security within ten (10) **Days** after notice of the award of the **Contract**. If the successful bidder fails to execute the **Contract** and furnish the required payment and performance security, the **City** shall retain such bid security as set forth in the Information for Bidders. If the successful bidder executes the

Contract and furnishes the required payment and performance security, the **City** shall return the bid security within a reasonable time after the furnishing of such bonds and execution of the **Contract** by the **City**.

19.2 If performance and payment bonds are not required, the bid security shall be retained by the **City** as security for the **Contractor**'s faithful performance of the **Contract**. If partial payments are provided, the bid security will be returned to the **Contractor** after the sum retained under Article 21 equals the amount of the bid security, subject to other provisions of this **Contract**. If partial payments are not provided, the bid security will be released when final payment is certified by the **City** for payment.

19.3 If the **Contractor** is declared in default under Article 48 prior to the return of the deposit, or if any claim is made such as referred to in Article 23, the amount of such deposit, or so much thereof as the **Comptroller** may deem necessary, may be retained and then applied by the **Comptroller**:

19.3.1 To compensate the **City** for any expense, loss or damage suffered or incurred by reason of or resulting from such default, including the cost of re-letting and liquidated damages; or

19.3.2 To indemnify the **City** against any and all claims.

ARTICLE 20. PAYMENT GUARANTEE

20.1 On **Contracts** where one hundred (100%) percent performance bonds and payment bonds are executed, this Article 20 does not apply.

20.2 In the event the terms of this **Contract** do not require the **Contractor** to provide a payment bond or where the **Contract** does not require a payment bond for one hundred (100%) percent of the **Contract** price, the **City** shall, in accordance with the terms of this Article 20, guarantee payment of all lawful claims for:

20.2.1 Wages and compensation for labor performed and/or services rendered; and

20.2.2 Materials, equipment, and supplies provided, whether incorporated into the **Work** or not, when demands have been filed with the **City** as provided hereinafter by any person, firm, or corporation which furnished labor, material, equipment, supplies, or any combination thereof, in connection with the **Work** performed hereunder (hereinafter referred to as the "beneficiary") at the direction of the **City** or the **Contractor**.

20.3 The provisions of Article 20.2 are subject to the following limitations and conditions:

20.3.1 If the **Contractor** provides a payment bond for a value that is less than one hundred (100%) percent of the value of the **Contract Work**, the payment bond provided by the **Contractor** shall be primary (and non-contributing) to the payment guarantee provided under this Article 20.

20.3.2 The guarantee is made for the benefit of all beneficiaries as defined in Article 20.2 provided that those beneficiaries strictly adhere to the terms and conditions of Article 20.3.4 and 20.3.5.

20.3.3 Nothing in this Article 20 shall prevent a beneficiary providing labor, services or material for the **Work** from suing the **Contractor** for any amounts due and owing the beneficiary by the **Contractor**.

20.3.4 Every person who has furnished labor or material, to the **Contractor** or to a **Subcontractor** of the **Contractor**, in the prosecution of the **Work** and who has not been paid in full therefor before the expiration of a period of ninety (90) **Days** after the date on which the last of the labor was performed or material was furnished by him/her for which the claim is made, shall have the right to sue on this payment guarantee in his/her own name for the amount, or the balance thereof, unpaid at the time of commencement of the action; provided, however, that a person having a direct contractual relationship with a **Subcontractor** of the **Contractor** but no contractual relationship express or implied with the **Contractor** shall not have a right of action upon the guarantee unless he/she shall have given written notice to the **Contractor** within one hundred twenty (120) **Days** from the date on which the last of the labor was performed or the last of the material was furnished, for which his/her claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the material was furnished or for whom the labor was performed. The notice shall be served by delivering the same personally to the **Contractor** or by mailing the same by registered mail, postage prepaid, in an envelope addressed to the **Contractor** at any place where it maintains an office or conducts its business; provided, however, that where such notice is actually received by the **Contractor** by other means, such notice shall be deemed sufficient.

20.3.5 Except as provided in Labor Law Section 220-g, no action on this payment guarantee shall be commenced after the expiration of the one-year limitations period set forth in Section 137(4)(b) of the State Finance Law.

20.3.6 The **Contractor** shall promptly forward to the **City** any notice or demand received pursuant to Article 20.3.4. The **Contractor** shall inform the **City** of any defenses to the notice or demand and shall forward to the **City** any documents the **City** requests concerning the notice or demand.

20.3.7 All demands made against the **City** by a beneficiary of this payment guarantee shall be presented to the **Engineer** along with all written documentation concerning the demand which the **Engineer** deems reasonably appropriate or necessary, which may include, but shall not be limited to: the subcontract; any invoices presented to the **Contractor** for payment; the notarized statement of the beneficiary that the demand is due and payable, that a request for payment has been made of the **Contractor** and that the demand has not been paid by the **Contractor** within the time allowed for such payment by the subcontract; and copies of any correspondence between the beneficiary and the **Contractor** concerning such demand. The **City** shall notify the **Contractor** that a demand has been made. The **Contractor** shall inform the **City** of any defenses to the demand and shall forward to the **City** any documents the **City** requests concerning the demand.

20.3.8 The **City** shall make payment only if, after considering all defenses presented by the **Contractor**, it determines that the payment is due and owing to the beneficiary making the demand.

20.3.9 No beneficiary shall be entitled to interest from the **City**, or to any other costs, including, but not limited to, attorneys' fees, except to the extent required by State Finance Law Section 137.

20.4 Upon the receipt by the **City** of a demand pursuant to this Article 20, the **City** may withhold from any payment otherwise due and owing to the **Contractor** under this **Contract** an amount sufficient to satisfy the demand.

20.4.1 In the event the **City** determines that the demand is valid, the **City** shall notify the **Contractor** of such determination and the amount thereof and direct the **Contractor** to immediately pay such amount to the beneficiary. In the event the **Contractor**, within seven (7) **Days** of receipt of such notification from the **City**, fails to pay the beneficiary, such failure shall constitute an automatic and irrevocable assignment of payment by the **Contractor** to the beneficiary for the amount of the demand determined by the **City** to be valid. The **Contractor**, without further notification or other process, hereby gives its unconditional consent to such assignment of payment to the beneficiary and authorizes the **City**, on its behalf, to take all necessary actions to implement such assignment of payment, including without limitation the execution of any instrument or documentation necessary to effectuate such assignment.

20.4.2In the event that the amount otherwise due and owing to the **Contractor** by the **City** is insufficient to satisfy such demand, the **City** may, at its option, require payment from the **Contractor** of an amount sufficient to cover such demand and exercise any other right to require or recover payment which the **City** may have under **Law** or **Contract**.

20.4.3 In the event the **City** determines that the demand is invalid, any amount withheld pending the **City**'s review of such demand shall be paid to the **Contractor**; provided, however, no lien has been filed. In the event a claim or an action has been filed, the terms and conditions set forth in Article 23 shall apply. In the event a lien has been filed, the parties will be governed by the provisions of the Lien Law of the State of New York.

20.5 The provisions of this Article 20 shall not prevent the **City** and the **Contractor** from resolving disputes in accordance with the **PPB** Rules, where applicable.

20.6 In the event the **City** determines that the beneficiary is entitled to payment pursuant to this Article 20, such determination and any defenses and counterclaims raised by the **Contractor** shall be taken into account in evaluating the **Contractor's** performance.

20.7 Nothing in this Article 20 shall relieve the **Contractor** of the obligation to pay the claims of all persons with valid and lawful claims against the **Contractor** relating to the **Work**.

20.8 The **Contractor** shall not require any performance, payment or other bonds of any **Subcontractor** if this **Contract** does not require such bonds of the **Contractor**.

20.9 The payment guarantee made pursuant to this Article 20 shall be construed in a manner consistent with Section 137 of the State Finance Law and shall afford to persons furnishing labor or materials to the **Contractor** or its **Subcontractors** in the prosecution of the **Work** under this **Contract** all of the rights and remedies afforded to such persons by such section, including but not limited to, the right to commence an action against the **City** on the payment guarantee provided by this Article 20 within the one-year limitations period set forth in Section 137(4)(b).

ARTICLE 21. RETAINED PERCENTAGE

21.1 If this **Contract** requires one hundred (100%) percent performance and payment security, then as further security for the faithful performance of this **Contract**, the **Commissioner** shall deduct, and

retain until the substantial completion of the **Work**, five (5%) percent of the value of **Work** certified for payment in each partial payment voucher.

21.2 If this **Contract** does not require one hundred (100%) percent performance and payment security and if the price for which this **Contract** was awarded does not exceed one million ($1,000,000) dollars, then as further security for the faithful performance of this **Contract**, the **Commissioner** shall deduct, and retain until the substantial completion of the **Work**, five (5%) percent of the value of **Work** certified for payment in each partial payment voucher.

21.3 If this **Contract** does not require one hundred (100%) percent performance and payment security and if the price for which this **Contract** was awarded exceeds one million ($1,000,000) dollars, then as further security for the faithful performance of this **Contract,** the **Commissioner** shall deduct, and retain until the substantial completion of the **Work**, up to ten (10%) percent of the value of **Work** certified for payment in each partial payment voucher. The percentage to be retained is set forth in Schedule A of the General Conditions.

ARTICLE 22. INSURANCE

22.1 Types of Insurance: The **Contractor** shall procure and maintain the following types of insurance if, and as indicated, in Schedule A of the General Conditions (with the minimum limits and special conditions specified in Schedule A). Such insurance shall be maintained from the date the **Contractor** is required to provide Proof of Insurance pursuant to Article 22.3.1 through the date of completion of all required **Work** (including punch list work as certified in writing by the **Resident Engineer**), except for insurance required pursuant to Article 22.1.4, which may terminate upon **Substantial Completion** of the **Contract**. All insurance shall meet the requirements set forth in this Article 22. Wherever this Article requires that insurance coverage be "at least as broad" as a specified form (including all ISO forms), there is no obligation that the form itself be used, provided that the **Contractor** can demonstrate that the alternative form or endorsement contained in its policy provides coverage at least as broad as the specified form.

22.1.1 Commercial General Liability Insurance: The **Contractor** shall provide Commercial General Liability Insurance covering claims for property damage and/or bodily injury, including death, which may arise from any of the operations under this **Contract**. Coverage under this insurance shall be at least as broad as that provided by the latest edition of Insurance Services Office ("ISO") Form CG 0001. Such insurance shall be "occurrence" based rather than "claims-made" and include, without limitation, the following types of coverage: premises operations; products and completed operations; contractual liability (including the tort liability of another assumed in a contract); broad form property damage; independent contractors; explosion, collapse and underground (XCU); construction means and methods; and incidental malpractice. Such insurance shall contain a "per project" aggregate limit, as specified in Schedule A, that applies separately to operations under this **Contract**.

22.1.1(a) Such Commercial General Liability Insurance shall name the **City** as an Additional Insured. Coverage for the City shall specifically include the **City's** officials and employees, be at least as broad as the latest edition of ISO Form CG 20 10 and provide completed operations coverage at least as broad as the latest edition of ISO Form CG 20 37.

22.1.1(b) Such Commercial General Liability Insurance shall name all other entities designated as additional insureds in Schedule A but only for claims arising from the

Contractor's operations under this **Contract**, with coverage at least as broad as the latest edition of ISO Form CG 20 26.

22.1.1(c) If the **Work** requires a permit from the Department of Buildings pursuant to 1 RCNY Section 101-08, the **Contractor** shall provide Commercial General Liability Insurance with limits of at least those required by 1 RCNY section 101-08 or greater limits required by the Agency in accordance with Schedule A. If the **Work** does not require such a permit, the minimum limits shall be those provided for in Schedule A.

22.1.1(d) If any of the **Work** includes repair of a waterborne vessel owned by or to be delivered to the **City**, such Commercial General Liability shall include, or be endorsed to include, Ship Repairer's Legal Liability Coverage to protect against, without limitation, liability arising from navigation of such vessels prior to delivery to and acceptance by the **City**.

22.1.2 Workers' Compensation Insurance, Employers' Liability Insurance, and Disability Benefits Insurance: The **Contractor** shall provide, and shall cause its **Subcontractors** to provide, Workers Compensation Insurance, Employers' Liability Insurance, and Disability Benefits Insurance in accordance with the **Laws** of the State of New York on behalf of all employees providing services under this **Contract** (except for those employees, if any, for which the **Laws** require insurance only pursuant to Article 22.1.3).

22.1.3 United States Longshoremen's and Harbor Workers Act and/or Jones Act Insurance: If specified in Schedule A of the General Conditions or if required by **Law**, the **Contractor** shall provide insurance in accordance with the United States Longshoremen's and Harbor Workers Act and/or the Jones Act, on behalf of all qualifying employees providing services under this **Contract**.

22.1.4 Builders Risk Insurance: If specified in Schedule A of the General Conditions, the **Contractor** shall provide Builders Risk Insurance on a completed value form for the total value of the **Work** through **Substantial Completion** of the **Work** in its entirety. Such insurance shall be provided on an All Risk basis and include coverage, without limitation, for windstorm (including named windstorm), storm surge, flood and earth movement. Unless waived by the **Commissioner**, it shall include coverage for ordinance and law, demolition and increased costs of construction, debris removal, pollutant clean up and removal, and expediting costs. Such insurance shall cover, without limitation, (a) all buildings and/or structures involved in the **Work**, as well as temporary structures at the **Site**, and (b) any property that is intended to become a permanent part of such building or structure, whether such property is on the **Site**, in transit or in temporary storage. Policies shall name the **Contractor** as Named Insured and list the **City** as both an Additional Insured and a Loss Payee as its interest may appear.

22.1.4(a) Policies of such insurance shall specify that, in the event a loss occurs at an occupied facility, occupancy of such facility is permitted without the consent of the issuing insurance company.

22.1.4(b) Such insurance may be provided through an Installation Floater, at the **Contractor's** option, if it otherwise conforms with the requirements of this Article 22.1.4.

22.1.5 Commercial Automobile Liability Insurance: The **Contractor** shall provide Commercial Automobile Liability Insurance for liability arising out of ownership,

maintenance or use of any owned (if any), non-owned and hired vehicles to be used in connection with this **Contract**. Coverage shall be at least as broad as the latest edition of ISO Form CA0001. If vehicles are used for transporting hazardous materials, the Automobile Liability Insurance shall be endorsed to provide pollution liability broadened coverage for covered vehicles (endorsement CA 99 48) as well as proof of MCS 90.

22.1.6 Contractors Pollution Liability Insurance: If specified in Schedule A of the General Conditions, the **Contractor** shall maintain, or cause the **Subcontractor** doing such **Work** to maintain, Contractors Pollution Liability Insurance covering bodily injury and property damage. Such insurance shall provide coverage for actual, alleged or threatened emission, discharge, dispersal, seepage, release or escape of pollutants (including asbestos), including any loss, cost or expense incurred as a result of any cleanup of pollutants (including asbestos) or in the investigation, settlement or defense of any claim, action, or proceedings arising from the operations under this **Contract**. Such insurance shall be in the **Contractor's** name and list the **City** as an Additional Insured and any other entity specified in Schedule A. Coverage shall include, without limitation, (a) loss of use of damaged property or of property that has not been physically injured, (b) transportation, and (c) non-owned disposal sites.

22.1.6(a) Coverage for the **City** as Additional Insured shall specifically include the **City's** officials and employees and be at least as broad as provided to the **Contractor** for this **Project**.

22.1.6(b) If such insurance is written on a claims-made policy, such policy shall have a retroactive date on or before the effective date of this **Contract**, and continuous coverage shall be maintained, or an extended discovery period exercised, for a period of not less than three (3) years from the time the **Work** under this **Contract** is completed.

22.1.7 Marine Insurance:

22.1.7(a) Marine Protection and Indemnity Insurance: If specified in Schedule A of the General Conditions or if the **Contractor** engages in marine operations in the execution of any part of the **Work**, the **Contractor** shall maintain, or cause the **Subcontractor** doing such Work to maintain, Marine Protection and Indemnity Insurance with coverage at least as broad as Form SP-23. The insurance shall provide coverage for the **Contractor** or **Subcontractor** (whichever is doing this **Work**) and for the **City** (together with its officials and employees) and any other entity specified in Schedule A as an Additional Insured for bodily injury and property damage arising from marine operations under this **Contract**. Coverage shall include, without limitation, injury or death of crew members (if not fully provided through other insurance), removal of wreck, damage to piers, wharves and other fixed or floating objects and loss of or damage to any other vessel or craft, or to property on such other vessel or craft.

22.1.7(b) Hull and Machinery Insurance: If specified in Schedule A of the General Conditions or if the **Contractor** engages in marine operations in the execution of any part of the **Work**, the **Contractor** shall maintain, or cause the **Subcontractor** doing such **Work** to maintain, Hull and Machinery Insurance with coverage for the **Contractor** or **Subcontractor** (whichever is doing this Work) and for the **City** (together with its officials and employees) as Additional Insured at least as broad as the latest edition of American Institute Tug Form for all tugs used under this

Contract and Collision Liability at least as broad as the latest edition of American Institute Hull Clauses.

22.1.7(c) Marine Pollution Liability Insurance: If specified in Schedule A of the General Conditions or if the **Contractor** engages in marine operations in the execution of any part of the **Work**, the **Contractor** shall maintain, or cause the **Subcontractor** doing such Work to maintain, Marine Pollution Liability Insurance covering itself (or the Subcontractor doing such Work) as Named Insured and the **City** (together with its officials and employees) and any other entity specified in Schedule A as an Additional Insured. Coverage shall be at least as broad as that provided by the latest edition of Water Quality Insurance Syndicate Form and include, without limitation, liability arising from the discharge or substantial threat of a discharge of oil, or from the release or threatened release of a hazardous substance including injury to, or economic losses resulting from, the destruction of or damage to real property, personal property or natural resources.

22.1.8 The **Contractor** shall provide such other types of insurance, at such minimum limits and with such conditions, as are specified in Schedule A of the General Conditions.

22.2 General Requirements for Insurance Coverage and Policies:

22.2.1 All required insurance policies shall be maintained with companies that may lawfully issue the required policy and have an A.M. Best rating of at least A-/VII or a Standard and Poor's rating of at least A, unless prior written approval is obtained from the **City** Corporation Counsel.

22.2.2 The **Contractor** shall be solely responsible for the payment of all premiums for all required policies and all deductibles and self-insured retentions to which such policies are subject, whether or not the **City** is an insured under the policy.

22.2.3 In his/her sole discretion, the **Commissioner** may, subject to the approval of the **Comptroller** and the **City** Corporation Counsel, accept Letters of Credit and/or custodial accounts in lieu of required insurance.

22.2.4 The **City's** limits of coverage for all types of insurance required pursuant to Schedule A of the General Conditions shall be the greater of (i) the minimum limits set forth in Schedule A or (ii) the limits provided to the **Contractor** as Named Insured under all primary, excess, and umbrella policies of that type of coverage.

22.2.5 The **Contractor** may satisfy its insurance obligations under this Article 22 through primary policies or a combination of primary and excess/umbrella policies, so long as all policies provide the scope of coverage required herein.

22.2.6 Policies of insurance provided pursuant to this Article 22 shall be primary and non-contributing to any insurance or self-insurance maintained by the **City**.

22.3 Proof of Insurance:

22.3.1 For all types of insurance required by Article 22.1 and Schedule A, except for insurance required by Articles 22.1.4 and 22.1.7, the **Contractor** shall file proof of insurance in accordance with this Article 22.3 within ten (10) **Days** of award. For insurance

provided pursuant to Articles 22.1.4 and 22.1.7, proof shall be filed by a date specified by the **Commissioner** or ten (10) **Days** prior to the commencement of the portion of the **Work** covered by such policy, whichever is earlier.

22.3.2 For Workers' Compensation Insurance provided pursuant to Article 22.1.2, the **Contractor** shall submit one of the following forms: C-105.2 Certificate of Workers' Compensation Insurance; U-26.3 - State Insurance Fund Certificate of Workers' Compensation Insurance; Request for WC/DB Exemption (Form CE-200); equivalent or successor forms used by the New York State Workers' Compensation Board; or other proof of insurance in a form acceptable to the **Commissioner**. For Disability Benefits Insurance provided pursuant to Article 22.1.2, the Contractor shall submit DB-120.1 - Certificate Of Insurance Coverage Under The NYS Disability Benefits Law, Request for WC/DB Exemption (Form CE-200); equivalent or successor forms used by the New York State Workers' Compensation Board; or other proof of insurance in a form acceptable to the **Commissioner**. ACORD forms are not acceptable.

22.3.3 For policies provided pursuant to all of Article 22.1 other than Article 22.1.2, the **Contractor** shall submit one or more Certificates of Insurance on forms acceptable to the **Commissioner**. All such Certificates of Insurance shall certify (a) the issuance and effectiveness of such policies of insurance, each with the specified minimum limits (b) for insurance secured pursuant to Article 22.1.1 that the **City** and any other entity specified in Schedule A is an Additional Insured thereunder; (c) in the event insurance is required pursuant to Article 22.1.6 and/or Article 22.1.7, that the City is an Additional Insured thereunder; (d) the company code issued to the insurance company by the National Association of Insurance Commissioners (the NAIC number); and (e) the number assigned to the **Contract** by the **City**. All such Certificates of Insurance shall be accompanied by either a duly executed "Certification by Insurance Broker or Agent" in the form contained in Part III of Schedule A or copies of all policies referenced in such Certificate of Insurance as certified by an authorized representative of the issuing insurance carrier. If any policy is not available at the time of submission, certified binders may be submitted until such time as the policy is available, at which time a certified copy of the policy shall be submitted.

22.3.4 Documentation confirming renewals of insurance shall be submitted to the **Commissioner** prior to the expiration date of coverage of policies required under this **Contract**. Such proofs of insurance shall comply with the requirements of Articles 22.3.2 and 22.3.3.

22.3.5 The **Contractor** shall be obligated to provide the **City** with a copy of any policy of insurance provided pursuant to this Article 22 upon the demand for such policy by the **Commissioner** or the **City** Corporation Counsel.

22.4 Operations of the **Contractor**:

22.4.1 The **Contractor** shall not commence the **Work** unless and until all required certificates have been submitted to and accepted by the **Commissioner**. Acceptance by the **Commissioner** of a certificate does not excuse the **Contractor** from securing insurance consistent with all provisions of this Article 22 or of any liability arising from its failure to do so.

22.4.2 The **Contractor** shall be responsible for providing continuous insurance coverage in the manner, form, and limits required by this **Contract** and shall be authorized to perform **Work** only during the effective period of all required coverage.

22.4.3 In the event that any of the required insurance policies lapse, are revoked, suspended or otherwise terminated, for whatever cause, the **Contractor** shall immediately stop all **Work**, and shall not recommence **Work** until authorized in writing to do so by the **Commissioner**. Upon quitting the **Site**, except as otherwise directed by the **Commissioner**, the **Contractor** shall leave all plant, materials, equipment, tools, and supplies on the **Site**. **Contract** time shall continue to run during such periods and no extensions of time will be granted. The **Commissioner** may also declare the **Contractor** in default for failure to maintain required insurance.

22.4.4 In the event the **Contractor** receives notice, from an insurance company or other person, that any insurance policy required under this Article 22 shall be cancelled or terminated (or has been cancelled or terminated) for any reason, the **Contractor** shall immediately forward a copy of such notice to both the **Commissioner** and the New York City Comptroller, attn: Office of Contract Administration, Municipal Building, One Centre Street, room 1005, New York, New York 10007. Notwithstanding the foregoing, the **Contractor** shall ensure that there is no interruption in any of the insurance coverage required under this Article 22.

22.4.5 Where notice of loss, damage, occurrence, accident, claim or suit is required under an insurance policy maintained in accordance with this Article 22, the **Contractor** shall notify in writing all insurance carriers that issued potentially responsive policies of any such event relating to any operations under this **Contract** (including notice to Commercial General Liability insurance carriers for events relating to the **Contractor**'s own employees) no later than 20 days after such event. For any policy where the **City** is an Additional Insured, such notice shall expressly specify that "this notice is being given on behalf of the City of New York as Insured as well as the Named Insured." Such notice shall also contain the following information: the number of the insurance policy, the name of the named insured, the date and location of the damage, occurrence, or accident, and the identity of the persons or things injured, damaged or lost. The **Contractor** shall simultaneously send a copy of such notice to the City of New York c/o Insurance Claims Specialist, Affirmative Litigation Division, New York City Law Department, 100 Church Street, New York, New York 10007.

22.4.6 In the event of any loss, accident, claim, action, or other event that does or can give rise to a claim under any insurance policy required under this Article 22, the **Contractor** shall at all times fully cooperate with the **City** with regard to such potential or actual claim.

22.5 **Subcontractor** Insurance: In the event the **Contractor** requires any **Subcontractor** to procure insurance with regard to any operations under this **Contract** and requires such **Subcontractor** to name the **Contractor** as an **Additional Insured** thereunder, the **Contractor** shall ensure that the **Subcontractor** name the **City**, including its officials and employees, as an Additional Insured with coverage at least as broad as the most recent edition of ISO Form CG 20 26.

22.6 Wherever reference is made in Article 7 or this Article 22 to documents to be sent to the **Commissioner** (e.g., notices, filings, or submissions), such documents shall be sent to the address set forth in Schedule A of the General Conditions. In the event no address is set forth in Schedule A, such documents are to be sent to the **Commissioner's** address as provided elsewhere in this **Contract**.

22.7 Apart from damages or losses covered by insurance provided pursuant to Articles 22.1.2, 22.1.3, or 22.1.5, the **Contractor** waives all rights against the **City**, including its officials and employees, for any damages or losses that are covered under any insurance required under this Article 22 (whether or

not such insurance is actually procured or claims are paid thereunder) or any other insurance applicable to the operations of the **Contractor** and/or its employees, agents, or **Subcontractors**.

22.8 In the event the **Contractor** utilizes a self-insurance program to satisfy any of the requirements of this Article 22, the **Contractor** shall ensure that any such self-insurance program provides the **City** with all rights that would be provided by traditional insurance under this Article 22, including but not limited to the defense and indemnification obligations that insurers are required to undertake in liability policies.

22.9 Materiality/Non-Waiver: The **Contractor's** failure to secure policies in complete conformity with this Article 22, or to give an insurance company timely notice of any sort required in this **Contract** or to do anything else required by this Article 22 shall constitute a material breach of this **Contract**. Such breach shall not be waived or otherwise excused by any action or inaction by the **City** at any time.

22.10 Pursuant to General Municipal Law Section 108, this **Contract** shall be void and of no effect unless **Contractor** maintains Workers' Compensation Insurance for the term of this **Contract** to the extent required and in compliance with the New York State Workers' Compensation Law.

22.11 Other Remedies: Insurance coverage provided pursuant to this Article 22 or otherwise shall not relieve the **Contractor** of any liability under this **Contract**, nor shall it preclude the **City** from exercising any rights or taking such other actions available to it under any other provisions of this **Contract** or **Law**.

ARTICLE 23. MONEY RETAINED AGAINST CLAIMS

23.1 If any claim shall be made by any person or entity (including **Other Contractors** with the **City** on this **Project**) against the **City** or against the **Contractor** and the **City** for any of the following:

(a) An alleged loss, damage, injury, theft or vandalism of any of the kinds referred to in Articles 7 and 12, plus the reasonable costs of defending the **City**, which in the opinion of the **Comptroller** may not be paid by an insurance company (for any reason whatsoever); or

(b) An infringement of copyrights, patents or use of patented articles, tools, etc., as referred to in Article 57; or

(c) Damage claimed to have been caused directly or indirectly by the failure of the **Contractor** to perform the **Work** in strict accordance with this **Contract,**

the amount of such claim, or so much thereof as the **Comptroller** may deem necessary, may be withheld by the **Comptroller**, as security against such claim, from any money due hereunder. The **Comptroller**, in his/her discretion, may permit the **Contractor** to substitute other satisfactory security in lieu of the monies so withheld.

23.2 If an action on such claim is timely commenced and the liability of the **City**, or the **Contractor**, or both, shall have been established therein by a final judgment of a court of competent jurisdiction, or if such claim shall have been admitted by the **Contractor** to be valid, the **Comptroller** shall pay such judgment or admitted claim out of the monies retained by the **Comptroller** under the provisions of this Article 23, and return the balance, if any, without interest, to the **Contractor**.

ARTICLE 24. MAINTENANCE AND GUARANTY

24.1 The **Contractor** shall promptly repair, replace, restore or rebuild, as the **Commissioner** may determine, any finished **Work** in which defects of materials or workmanship may appear or to which damage may occur because of such defects, during the one (1) year period subsequent to the date of **Substantial Completion** (or use and occupancy in accordance with Article 16), except where other periods of maintenance and guaranty are provided for in Schedule A.

24.2 As security for the faithful performance of its obligations hereunder, the **Contractor**, upon filing its requisition for payment on **Substantial Completion**, shall deposit with the **Commissioner** a sum equal to one (1%) percent of the price (or the amount fixed in Schedule A of the General Conditions) in cash or certified check upon a state or national bank and trust company or a check of such bank and trust company signed by a duly authorized officer thereof and drawn to the order of the **Comptroller**, or obligations of the **City**, which the **Comptroller** may approve as of equal value with the sum so required.

24.3 In lieu of the above, the **Contractor** may make such security payment to the **City** by authorizing the **Commissioner** in writing to deduct the amount from the **Substantial Completion** payment which shall be deemed the deposit required above.

24.4 If the **Contractor** has faithfully performed all of its obligations hereunder the **Commissioner** shall so certify to the **Comptroller** within five (5) **Days** after the expiration of one (1) year from the date of **Substantial Completion** and acceptance of the **Work** or within thirty (30) **Days** after the expiration of the guarantee period fixed in the **Specifications**. The security payment shall be repaid to the **Contractor** without interest within thirty (30) **Days** after certification by the **Commissioner** to the **Comptroller** that the **Contractor** has faithfully performed all of its obligations hereunder.

24.5 Notice by the **Commissioner** to the **Contractor** to repair, replace, rebuild or restore such defective or damaged **Work** shall be timely, pursuant to this article, if given not later than ten (10) **Days** subsequent to the expiration of the one (1) year period or other periods provided for herein.

24.6 If the **Contractor** shall fail to repair, replace, rebuild or restore such defective or damaged **Work** promptly after receiving such notice, the **Commissioner** shall have the right to have the **Work** done by others in the same manner as provided for in the completion of a defaulted **Contract**, under Article 51.

24.7 If the security payment so deposited is insufficient to cover the cost of such **Work**, the **Contractor** shall be liable to pay such deficiency on demand by the **Commissioner**.

24.8 The **Engineer's** certificate setting forth the fair and reasonable cost of repairing, replacing, rebuilding or restoring any damaged or defective **Work** when performed by one other than the **Contractor**, shall be binding and conclusive upon the **Contractor** as to the amount thereof.

24.9 The **Contractor** shall obtain all manufacturers' warranties and guaranties of all equipment and materials required by this **Contract** in the name of the **City** and shall deliver same to the **Commissioner**. All of the **City's** rights and title and interest in and to said manufacturers' warranties and guaranties may be assigned by the **City** to any subsequent purchasers of such equipment and materials or lessees of the premises into which the equipment and materials have been installed.

CHAPTER VI: CHANGES, EXTRA WORK, AND DOCUMENTATION OF CLAIM

ARTICLE 25. CHANGES

25.1 Changes may be made to this **Contract** only as duly authorized in writing by the **Commissioner** in accordance with the **Law** and this **Contract**. All such changes, modifications, and amendments will become a part of the **Contract**. **Work** so ordered shall be performed by the **Contractor**.

25.2 **Contract** changes will be made only for **Work** necessary to complete the **Work** included in the original scope of the **Contract** and/or for non-material changes to the scope of the **Contract**. Changes are not permitted for any material alteration in the scope of **Work** in the **Contract**.

25.3 The **Contractor** shall be entitled to a price adjustment for **Extra Work** performed pursuant to a written change order. Adjustments to price shall be computed in one or more of the following ways:

25.3.1 By applicable unit prices specified in the **Contract**; and/or

25.3.2 By agreement of a fixed price; and/or

25.3.3 By time and material records; and/or

25.3.4 In any other manner approved by the **CCPO**.

25.4 All payments for change orders are subject to pre-audit by the **Engineering Audit Officer** and may be post-audited by the **Comptroller** and/or the **Agency**.

ARTICLE 26. METHODS OF PAYMENT FOR OVERRUNS AND EXTRA WORK

26.1 Overrun of Unit Price Item: An overrun is any quantity of a unit price item which the **Contractor** is directed to provide which is in excess of one hundred twenty-five (125%) percent of the estimated quantity for that item set forth in the bid schedule.

26.1.1For any unit price item, the **Contractor** will be paid at the unit price bid for any quantity up to one hundred twenty-five (125%) percent of the estimated quantity for that item set forth in the bid schedule. If during the progress of the **Work**, the actual quantity of any unit price item required to complete the **Work** approaches the estimated quantity for that item, and for any reason it appears that the actual quantity of any unit price item necessary to complete the **Work** will exceed the estimated quantity for that item by twenty-five (25%) percent, the **Contractor** shall immediately notify the **Engineer** of such anticipated overrun. The **Contractor** shall not be compensated for any quantity of a unit price item provided which is in excess of one hundred twenty-five (125%) percent of the estimated quantity for that item set forth in the bid schedule without written authorization from the **Engineer**.

26.1.2 If the actual quantity of any unit price item necessary to complete the **Work** will exceed one hundred twenty five (125%) percent of the estimated quantity for that item set forth in the bid schedule, the **City** reserves the right and the **Contractor** agrees to negotiate a new unit price for such item. In no event shall such negotiated new unit price exceed the unit bid price. If the **City** and **Contractor** cannot agree on a new unit price, then the **City** shall order the **Contractor** and the **Contractor** agrees to provide additional quantities of

the item on the basis of time and material records for the actual and reasonable cost as determined under Article 26.2, but in no event at a unit price exceeding the unit price bid.

26.2 **Extra Work:** For **Extra Work** where payment is by agreement on a fixed price in accordance with Article 25.3.2, the price to be paid for such **Extra Work** shall be based on the fair and reasonable estimated cost of the items set forth below. For **Extra Work** where payment is based on time and material records in accordance with Article 25.3.3, the price to be paid for such **Extra Work** shall be the actual and reasonable cost of the items set forth below, calculated in accordance with the formula specified therein, if any.

26.2.1 Necessary materials (including transportation to the **Site**); plus

26.2.2 Necessary direct labor, including payroll taxes (subject to statutory wage caps) and supplemental benefits; plus

26.2.3 Sales and personal property taxes, if any, required to be paid on materials not incorporated into such **Extra Work**; plus

26.2.4 Reasonable rental value of **Contractor**-owned (or **Subcontractor**-owned, as applicable), necessary plant and equipment other than **Small Tools**, plus fuel/energy costs. Except for fuel costs for pick-up trucks which shall be reimbursed based on a consumption of five (5) gallons per shift, fuel costs shall be reimbursed based on actual costs or, in the absence of auditable documentation, the following fuel consumption formula per operating hour: (.035) x (HP rating) x (Fuel cost/gallon). Reasonable rental value is defined as the lower of either seventy-five percent of the monthly prorated rental rates established in "The AED Green Book, Rental Rates and Specifications for Construction Equipment" published by Equipment Watch (the "Green Book"), or seventy-five percent of the monthly prorated rental rates established in the "Rental Rate Blue Book for Construction Equipment" published by Equipment Watch (the "Blue Book") (the applicable Blue Book rate being for rental only without the addition of any operational costs listed in the Blue Book). The reasonable rental value is deemed to be inclusive of all operating costs except for fuel/energy consumption and equipment operator's wages/costs. For multiple shift utilization, reimbursement shall be calculated as follows: first shift shall be seventy-five (75%) percent of such rental rates; second shift shall be sixty (60%) percent of the first shift rate; and third shift shall be forty (40%) percent of the first shift rate. Equipment on standby shall be reimbursed at one-third (1/3) the prorated monthly rental rate. **Contractor**-owned (or **Subcontractor**-owned, as applicable) equipment includes equipment from rental companies affiliated with or controlled by the **Contractor** (or **Subcontractor**, as applicable), as determined by the **Commissioner**. In establishing cost reimbursement for non-operating **Contractor**-owned (or **Subcontractor**-owned, as applicable) equipment (scaffolding, sheeting systems, road plates, etc.), the **City** may restrict reimbursement to a purchase-salvage/life cycle basis if less than the computed rental costs; plus

26.2.5 Necessary installation and dismantling of such plant and equipment, including transportation to and from the **Site**, if any, provided that, in the case of non-**Contractor**-owned (or non-**Subcontractor**-owned, as applicable) equipment rented from a third party, the cost of installation and dismantling are not allowable if such costs are included in the rental rate; plus

26.2.6 Necessary fees charged by governmental entities; plus

26.2.7 Necessary construction-related service fees charged by non-governmental entities, such as landfill tipping fees; plus

26.2.8 Reasonable rental costs of non-**Contractor**-owned (or non-**Subcontractor**-owned, as applicable) necessary plant and equipment other than **Small Tools**, plus fuel/energy costs. Except for fuel costs for pick-up trucks which shall be reimbursed based on a consumption of five (5) gallons per shift, fuel costs shall be reimbursed based on actual costs or, in the absence of auditable documentation, the following fuel consumption formula per hour of operation: (.035) x (HP rating) x (Fuel cost/gallon). In lieu of renting, the **City** reserves the right to direct the purchase of non-operating equipment (scaffolding, sheeting systems, road plates, etc.), with payment on a purchase-salvage/life cycle basis, if less than the projected rental costs; plus

26.2.9 Workers' Compensation Insurance, and any insurance coverage expressly required by the **City** for the performance of the **Extra Work** which is different than the types of insurance required by Article 22 and Schedule A of the General Conditions. The cost of Workers' Compensation Insurance is subject to applicable payroll limitation caps and shall be based upon the carrier's Manual Rate for such insurance derived from the applicable class Loss Cost ("LC") and carrier's Lost Cost Multiplier ("LCM") approved by the New York State Department of Financial Services, and with the exception of experience rating, rate modifiers as promulgated by the New York Compensation Insurance Rating Board ("NYCIRB"); plus

26.2.10 Additional costs incurred as a result of the **Extra Work** for performance and payment bonds; plus

26.2.11 Twelve percent (12%) percent of the total of items in Articles 26.2.1 through 26.2.5 as compensation for overhead, except that no percentage for overhead will be allowed on **Payroll Taxes** or on the premium portion of overtime pay or on sales and personal property taxes. Overhead shall include without limitation, all costs and expenses in connection with administration, management superintendence, small tools, and insurance required by Schedule A of the General Conditions other than Workers' Compensation Insurance; plus

26.2.12 Ten (10%) percent of the total of items in Articles 26.2.1 through 26.2.5, plus the items in Article 26.2.11, as compensation for profit, except that no percentage for profit will be allowed on **Payroll Taxes** or on the premium portion of overtime pay or on sales and personal property taxes; plus

26.2.13 Five (5%) percent of the total of items in Articles 26.2.6 through 26.2.10 as compensation for overhead and profit.

26.3 Where the **Extra Work** is performed in whole or in part by other than the **Contractor's** own forces pursuant to Article 26.2, the **Contractor** shall be paid, subject to pre-audit by the **Engineering Audit Officer**, the cost of such **Work** computed in accordance with Article 26.2 above, plus an additional allowance of five (5%) percent to cover the **Contractor's** overhead and profit.

26.4 Where a change is ordered, involving both **Extra Work** and omitted or reduced **Contract Work,** the **Contract** price shall be adjusted, subject to pre-audit by the **EAO**, in an amount based on the difference between the cost of such **Extra Work** and of the omitted or reduced **Work**.

26.5 Where the **Contractor** and the **Commissioner** can agree upon a fixed price for **Extra Work** in accordance with Article 25.3.2 or another method of payment for **Extra Work** in accordance with

Article 25.3.4, or for **Extra Work** ordered in connection with omitted **Work**, such method, subject to pre-audit by the **EAO**, may, at the option of the **Commissioner**, be substituted for the cost plus a percentage method provided in Article 26.2; provided, however, that if the **Extra Work** is performed by a **Subcontractor**, the **Contractor** shall not be entitled to receive more than an additional allowance of five (5%) percent for overhead and profit over the cost of such **Subcontractor's Work** as computed in accordance with Article 26.2.

ARTICLE 27. RESOLUTION OF DISPUTES

27.1 All disputes between the **City** and the **Contractor** of the kind delineated in this Article 27.1 that arise under, or by virtue of, this **Contract** shall be finally resolved in accordance with the provisions of this Article 27 and the **PPB** Rules. This procedure for resolving all disputes of the kind delineated herein shall be the exclusive means of resolving any such disputes.

27.1.1 This Article 27 shall not apply to disputes concerning matters dealt with in other sections of the **PPB** Rules, or to disputes involving patents, copyrights, trademarks, or trade secrets (as interpreted by the courts of New York State) relating to proprietary rights in computer software.

27.1.2 This Article 27 shall apply only to disputes about the scope of **Work** delineated by the **Contract**, the interpretation of **Contract** documents, the amount to be paid for **Extra Work** or disputed work performed in connection with the **Contract**, the conformity of the **Contractor's Work** to the **Contract**, and the acceptability and quality of the **Contractor's Work**; such disputes arise when the **Engineer**, **Resident Engineer**, **Engineering Audit Officer**, or other designee of the **Commissioner** makes a determination with which the **Contractor** disagrees.

27.2 All determinations required by this Article 27 shall be made in writing clearly stated, with a reasoned explanation for the determination based on the information and evidence presented to the party making the determination. Failure to make such determination within the time required by this Article 27 shall be deemed a non-determination without prejudice that will allow application to the next level.

27.3 During such time as any dispute is being presented, heard, and considered pursuant to this Article 27, the **Contract** terms shall remain in force and the **Contractor** shall continue to perform **Work** as directed by the **ACCO** or the **Engineer**. Failure of the **Contractor** to continue **Work** as directed shall constitute a waiver by the **Contractor** of its claim.

27.4 Presentation of Disputes to **Commissioner**.

Notice of Dispute and Agency Response. The **Contractor** shall present its dispute in writing ("Notice of Dispute") to the **Commissioner** within thirty (30) Days of receiving written notice of the determination or action that is the subject of the dispute. This notice requirement shall not be read to replace any other notice requirements contained in the **Contract**. The Notice of Dispute shall include all the facts, evidence, documents, or other basis upon which the **Contractor** relies in support of its position, as well as a detailed computation demonstrating how any amount of money claimed by the **Contractor** in the dispute was arrived at. Within thirty (30) Days after receipt of the detailed written submission comprising the complete Notice of Dispute, the **Engineer**, **Resident Engineer**, **Engineering Audit Officer**, or other designee of the **Commissioner** shall submit to the **Commissioner** all materials he or she deems pertinent to the dispute. Following initial submissions to the **Commissioner**, either party may demand of the other the production of any document or other material the demanding party believes may be relevant to the dispute. The requested party shall produce all relevant materials that are not otherwise

protected by a legal privilege recognized by the courts of New York State. Any question of relevancy shall be determined by the **Commissioner** whose decision shall be final. Willful failure of the **Contractor** to produce any requested material whose relevancy the **Contractor** has not disputed, or whose relevancy has been affirmatively determined, shall constitute a waiver by the **Contractor** of its claim.

27.4.1 **Commissioner** Inquiry. The **Commissioner** shall examine the material and may, in his or her discretion, convene an informal conference with the **Contractor**, the **ACCO**, and the **Engineer**, **Resident Engineer**, **Engineering Audit Officer**, or other designee of the **Commissioner** to resolve the issue by mutual consent prior to reaching a determination. The **Commissioner** may seek such technical or other expertise as he or she shall deem appropriate, including the use of neutral mediators, and require any such additional material from either or both parties as he or she deems fit. The **Commissioner's** ability to render, and the effect of, a decision hereunder shall not be impaired by any negotiations in connection with the dispute presented, whether or not the **Commissioner** participated therein. The **Commissioner** may or, at the request of any party to the dispute, shall compel the participation of any **Other Contractor** with a contract related to the **Work** of this **Contract**, and that **Contractor** shall be bound by the decision of the **Commissioner**. Any **Other Contractor** thus brought into the dispute resolution proceeding shall have the same rights and obligations under this Article 27 as the **Contractor** initiating the dispute.

27.4.2 **Commissioner** Determination. Within thirty (30) **Days** after the receipt of all materials and information, or such longer time as may be agreed to by the parties, the **Commissioner** shall make his or her determination and shall deliver or send a copy of such determination to the **Contractor**, the **ACCO,** and **Engineer**, **Resident Engineer**, **Engineering Audit Officer**, or other designee of the **Commissioner**, as applicable, together with a statement concerning how the decision may be appealed.

27.4.3 Finality of **Commissioner's** Decision. The **Commissioner's** decision shall be final and binding on all parties, unless presented to the Contract Dispute Resolution Board pursuant to this Article 27. The **City** may not take a petition to the Contract Dispute Resolution Board. However, should the **Contractor** take such a petition, the **City** may seek, and the Contract Dispute Resolution Board may render, a determination less favorable to the **Contractor** and more favorable to the **City** than the decision of the **Commissioner**.

27.5 Presentation of Dispute to the **Comptroller**. Before any dispute may be brought by the **Contractor** to the Contract Dispute Resolution Board, the **Contractor** must first present its claim to the **Comptroller** for his or her review, investigation, and possible adjustment.

27.5.1 Time, Form, and Content of Notice. Within thirty (30) **Days** of its receipt of a decision by the **Commissioner,** the **Contractor** shall submit to the **Comptroller** and to the **Commissioner** a Notice of Claim regarding its dispute with the **Agency**. The Notice of Claim shall consist of (i) a brief written statement of the substance of the dispute, the amount of money, if any, claimed and the reason(s) the **Contractor** contends the dispute was wrongly decided by the **Commissioner**; (ii) a copy of the written decision of the **Commissioner**; and (iii) a copy of all materials submitted by the **Contractor** to the **Agency**, including the Notice of Dispute. The **Contractor** may not present to the **Comptroller** any material not presented to the **Commissioner**, except at the request of the **Comptroller**.

27.5.2 Response. Within thirty (30) **Days** of receipt of the Notice of Claim, the **Agency** shall make available to the **Comptroller** a copy of all material submitted by the **Agency** to the **Commissioner** in connection with the dispute. The **Agency** may not present to the **Comptroller** any material not presented to the **Commissioner** except at the request of the **Comptroller**.

27.5.3 **Comptroller** Investigation. The **Comptroller** may investigate the claim in dispute and, in the course of such investigation, may exercise all powers provided in Sections 7-201 and 7-203 of the Administrative Code. In addition, the **Comptroller** may demand of either party, and such party shall provide, whatever additional material the **Comptroller** deems pertinent to the claim, including original business records of the **Contractor**. Willful failure of the **Contractor** to produce within fifteen (15) **Days** any material requested by the **Comptroller** shall constitute a waiver by the **Contractor** of its claim. The **Comptroller** may also schedule an informal conference to be attended by the **Contractor**, **Agency** representatives, and any other personnel desired by the **Comptroller**.

27.5.4 Opportunity of **Comptroller** to Compromise or Adjust Claim. The **Comptroller** shall have forty-five (45) **Days** from his or her receipt of all materials referred to in Article 27.5.3 to investigate the disputed claim. The period for investigation and compromise may be further extended by agreement between the **Contractor** and the **Comptroller**, to a maximum of ninety (90) **Days** from the **Comptroller's** receipt of all materials. The **Contractor** may not present its petition to the Contract Dispute Resolution Board until the period for investigation and compromise delineated in this Article 27.5.4 has expired. In compromising or adjusting any claim hereunder, the **Comptroller** may not revise or disregard the terms of the **Contract** between the parties.

27.6 Contract Dispute Resolution Board. There shall be a Contract Dispute Resolution Board composed of:

27.6.1 The chief administrative law judge of the Office of Administrative Trials and Hearings (OATH) or his/her designated OATH administrative law judge, who shall act as chairperson, and may adopt operational procedures and issue such orders consistent with this Article 27 as may be necessary in the execution of the Contract Dispute Resolution Board's functions, including, but not limited to, granting extensions of time to present or respond to submissions;

27.6.2 The **CCPO** or his/her designee; any designee shall have the requisite background to consider and resolve the merits of the dispute and shall not have participated personally and substantially in the particular matter that is the subject of the dispute or report to anyone who so participated; and

27.6.3 A person with appropriate expertise who is not an employee of the **City**. This person shall be selected by the presiding administrative law judge from a prequalified panel of individuals, established and administered by OATH with appropriate background to act as decision-makers in a dispute. Such individual may not have a contract or dispute with the **City** or be an officer or employee of any company or organization that does, or regularly represents persons, companies, or organizations having disputes with the **City**.

27.7 Petition to the Contract Dispute Resolution Board. In the event the claim has not been settled or adjusted by the **Comptroller** within the period provided in this Article 27, the **Contractor**,

within thirty (30) **Days** thereafter, may petition the Contract Dispute Resolution Board to review the **Commissioner's** determination.

27.7.1 Form and Content of Petition by **Contractor**. The **Contractor** shall present its dispute to the Contract Dispute Resolution Board in the form of a petition, which shall include (i) a brief written statement of the substance of the dispute, the amount of money, if any, claimed, and the reason(s) the **Contractor** contends the dispute was wrongly decided by the **Commissioner**; (ii) a copy of the written Decision of the **Commissioner,** (iii) copies of all materials submitted by the **Contractor** to the Agency; (iv) a copy of the written decision of the **Comptroller**, if any, and (v) copies of all correspondence with, or written material submitted by the **Contractor**, to the **Comptroller**. The **Contractor** shall concurrently submit four (4) complete sets of the Petition: one set to the **City** Corporation Counsel (Attn: Commercial and Real Estate Litigation Division) and three (3) sets to the Contract Dispute Resolution Board at OATH's offices with proof of service on the **City** Corporation Counsel. In addition, the **Contractor** shall submit a copy of the written statement of the substance of the dispute, cited in (i) above, to both the **Commissioner** and the **Comptroller**.

27.7.2 **Agency** Response. Within thirty (30) **Days** of its receipt of the Petition by the **City** Corporation Counsel, the **Agency** shall respond to the brief written statement of the **Contractor** and make available to the Contract Dispute Resolution Board all material it submitted to the **Commissioner** and **Comptroller**. Three (3) complete copies of the **Agency** response shall be provided to the Contract Dispute Resolution Board and one to the **Contractor**. Extensions of time for submittal of the **Agency** response shall be given as necessary upon a showing of good cause or, upon consent of the parties, for an initial period of up to thirty (30) Days.

27.7.3 Further Proceedings. The Contract Dispute Resolution Board shall permit the **Contractor** to present its case by submission of memoranda, briefs, and oral argument. The Contract Dispute Resolution Board shall also permit the **Agency** to present its case in response to the **Contractor** by submission of memoranda, briefs, and oral argument. If requested by the **City** Corporation Counsel, the **Comptroller** shall provide reasonable assistance in the preparation of the **Agency's** case. Neither the **Contractor** nor the **Agency** may support its case with any documentation or other material that was not considered by the **Comptroller**, unless requested by the Contract Dispute Resolution Board. The Contract Dispute Resolution Board, in its discretion, may seek such technical or other expert advice as it shall deem appropriate and may seek, on its own or upon application of a party, any such additional material from any party as it deems fit. The Contract Dispute Resolution Board, in its discretion, may combine more than one dispute between the parties for concurrent resolution.

27.7.4 Contract Dispute Resolution Board Determination. Within forty-five (45) **Days** of the conclusion of all written submissions and oral arguments, the Contract Dispute Resolution Board shall render a written decision resolving the dispute. In an unusually complex case, the Contract Dispute Resolution Board may render its decision in a longer period, not to exceed ninety (90) **Days**, and shall so advise the parties at the commencement of this period. The Contract Dispute Resolution Board's decision must be consistent with the terms of the **Contract**. Decisions of the Contract Dispute Resolution Board shall only resolve matters before the Contract Dispute Resolution Board and shall not have precedential effect with respect to matters not before the Contract Dispute Resolution Board.

27.7.5 Notification of Contract Dispute Resolution Board Decision. The Contract Dispute Resolution Board shall send a copy of its decision to the **Contractor**, the **ACCO**, the Engineer, the **Comptroller**, the **City** Corporation Counsel, the CCPO, and the **PPB**. A decision in favor of the **Contractor** shall be subject to the prompt payment provisions of the **PPB** Rules. The Required Payment Date shall be thirty (30) Days after the date the parties are formally notified of the Contract Dispute Resolution Board's decision.

27.7.6 Finality of Contract Dispute Resolution Board Decision. The Contract Dispute Resolution Board's decision shall be final and binding on all parties. Any party may seek review of the Contract Dispute Resolution Board's decision solely in the form of a challenge, filed within four (4) months of the date of the Contract Dispute Resolution Board's decision, in a court of competent jurisdiction of the State of New York, County of New York pursuant to Article 78 of the Civil Practice Law and Rules. Such review by the court shall be limited to the question of whether or not the Contract Dispute Resolution Board's decision was made in violation of lawful procedure, was affected by an error of **Law**, or was arbitrary and capricious or an abuse of discretion. No evidence or information shall be introduced or relied upon in such proceeding that was not presented to the Contract Dispute Resolution Board in accordance with this Article 27.

27.8 Any termination, cancellation, or alleged breach of the **Contract** prior to or during the pendency of any proceedings pursuant to this Article 27 shall not affect or impair the ability of the **Commissioner** or Contract Dispute Resolution Board to make a binding and final decision pursuant to this Article 27.

ARTICLE 28. RECORD KEEPING FOR EXTRA OR DISPUTED WORK OR WORK ON A TIME & MATERIALS BASIS

28.1 While the **Contractor** or any of its **Subcontractors** is performing **Work** on a time and material basis or **Extra Work** on a time and material basis ordered by the **Commissioner** under Article 25, or where the **Contractor** believes that it or any of its **Subcontractors** is performing **Extra Work** but a final determination by **Agency** has not been made, or the **Contractor** or any of its **Subcontractors** is performing disputed **Work** (whether on or off the **Site**), or complying with a determination or order under protest in accordance with Articles 11, 27, and 30, in each such case the **Contractor** shall furnish the **Resident Engineer** daily with three (3) copies of written statements signed by the **Contractor's** representative at the **Site** showing:

28.1.1 The name, trade, and number of each worker employed on such **Work** or engaged in complying with such determination or order, the number of hours employed, and the character of the **Work** each is doing; and

28.1.2 The nature and quantity of any materials, plant and equipment furnished or used in connection with the performance of such **Work** or compliance with such determination or order, and from whom purchased or rented.

28.2 A copy of such statement will be countersigned by the **Resident Engineer**, noting thereon any items not agreed to or questioned, and will be returned to the **Contractor** within two (2) **Days** after submission.

28.3 The **Contractor** and its **Subcontractors**, when required by the **Commissioner**, or the **Comptroller**, shall also produce for inspection, at the office of the **Contractor** or **Subcontractor**, any and all of its books, bid documents, financial statements, vouchers, records, daily job diaries and reports,

and cancelled checks, and any other documents relating to showing the nature and quantity of the labor, materials, plant and equipment actually used in the performance of such **Work**, or in complying with such determination or order, and the amounts expended therefor, and shall permit the **Commissioner** and the **Comptroller** to make such extracts therefrom, or copies thereof, as they or either of them may desire.

28.4 In connection with the examination provided for herein, the **Commissioner**, upon demand therefor, will produce for inspection by the **Contractor** such records as the **Agency** may have with respect to such **Extra Work** or disputed **Work** performed under protest pursuant to order of the **Commissioner**, except those records and reports which may have been prepared for the purpose of determining the accuracy and validity of the **Contractor's** claim.

28.5 Failure to comply strictly with these requirements shall constitute a waiver of any claim for extra compensation or damages on account of the performance of such **Work** or compliance with such determination or order.

ARTICLE 29. OMITTED WORK

29.1 If any **Contract Work** in a lump sum **Contract**, or if any part of a lump sum item in a unit price, lump sum, or percentage-bid **Contract** is omitted by the **Commissioner** pursuant to Article 33, the **Contract** price, subject to audit by the EAO, shall be reduced by a pro rata portion of the lump sum bid amount based upon the percent of **Work** omitted subject to Article 29.4. For the purpose of determining the pro rata portion of the lump sum bid amount, the bid breakdown submitted in accordance with Article 41 shall be considered, but shall not be the determining factor.

29.2 If the whole of a lump sum item or units of any other item is so omitted by the **Commissioner** in a unit price, lump sum, or percentage-bid **Contract**, then no payment will be made therefor except as provided in Article 29.4.

29.3 For units that have been ordered but are only partially completed, the unit price shall be reduced by a pro rata portion of the unit price bid based upon the percentage of **Work** omitted subject to Article 29.4.

29.4 In the event the **Contractor**, with respect to any omitted **Work**, has purchased any non-cancelable material and/or equipment that is not capable of use except in the performance of this **Contract** and has been specifically fabricated for the sole purpose of this **Contract**, but not yet incorporated into the **Work**, the **Contractor** shall be paid for such material and/or equipment in accordance with Article 64.2.1(b); provided, however, such payment is contingent upon the **Contractor's** delivery of such material and/or equipment in acceptable condition to a location designated by the **City**.

29.5 The **Contractor** agrees to make no claim for damages or for loss of overhead and profit with regard to any omitted **Work**.

ARTICLE 30. NOTICE AND DOCUMENTATION OF COSTS AND DAMAGES; PRODUCTION OF FINANCIAL RECORDS

30.1 If the **Contractor** shall claim to be sustaining damages by reason of any act or omission of the **City** or its agents, it shall submit to the **Commissioner** within forty-five (45) **Days** from the time such damages are first incurred, and every thirty (30) **Days** thereafter to the extent additional damages are being incurred for the same condition, verified statements of the details and the amounts of such

damages, together with documentary evidence of such damages. The **Contractor** may submit any of the above statements within such additional time as may be granted by the **Commissioner** in writing upon written request therefor. Failure of the **Commissioner** to respond in writing to a written request for additional time within thirty (30) **Days** shall be deemed a denial of the request. On failure of the **Contractor** to strictly comply with the foregoing provisions, such claims shall be deemed waived and no right to recover on such claims shall exist. Damages that the **Contractor** may claim in any action or dispute resolution procedure arising under or by reason of this **Contract** shall not be different from or in excess of the statements and documentation made pursuant to this Article 30. This Article 30.1 does not apply to claims submitted to the **Commissioner** pursuant to Article 11 or to claims disputing a determination under Article 27.

30.2 In addition to the foregoing statements, the **Contractor** shall, upon notice from the **Commissioner**, produce for examination at the **Contractor's** office, by the **Engineer**, **Architect** or **Project Manager**, all of its books of account, bills, invoices, payrolls, subcontracts, time books, daily reports, bank deposit books, bank statements, check books, and cancelled checks, showing all of its acts and transactions in connection with or relating to or arising by reason of this **Contract**, and submit itself and persons in its employment, for examination under oath by any person designated by the **Commissioner** or **Comptroller** to investigate claims made or disputes against the **City** under this **Contract**. At such examination, a duly authorized representative of the **Contractor** may be present.

30.3 In addition to the statements required under Article 28 and this Article 30, the **Contractor** and/or its **Subcontractor** shall, within thirty (30) **Days** upon notice from the **Commissioner** or **Comptroller**, produce for examination at the **Contractor's** and/or **Subcontractor's** office, by a representative of either the **Commissioner** or **Comptroller**, all of its books of account, bid documents, financial statements, accountant workpapers, bills, invoices, payrolls, subcontracts, time books, daily reports, bank deposit books, bank statements, check books, and cancelled checks, showing all of its acts and transactions in connection with or relating to or arising by reason of this **Contract**. Further, the **Contractor** and/or its **Subcontractor** shall submit any person in its employment, for examination under oath by any person designated by the **Commissioner** or **Comptroller** to investigate claims made or disputes against the **City** under this **Contract**. At such examination, a duly authorized representative of the **Contractor** may be present.

30.4 Unless the information and examination required under Article 30.3 is provided by the **Contractor** and/or its **Subcontractor** upon thirty (30) **Days'** notice from the **Commissioner** or **Comptroller**, or upon the **Commissioner's** or **Comptroller's** written authorization to extend the time to comply, the **City** shall be released from all claims arising under, relating to or by reason of this **Contract**, except for sums certified by the **Commissioner** to be due under the provisions of this **Contract**. It is further stipulated and agreed that no person has the power to waive any of the foregoing provisions and that in any action or dispute resolution procedure against the **City** to recover any sum in excess of the sums certified by the **Commissioner** to be due under or by reason of this **Contract**, the **Contractor** must allege in its complaint and prove, at trial or during such dispute resolution procedure, compliance with the provisions of this Article 30.

30.5 In addition, after the commencement of any action or dispute resolution procedure by the **Contractor** arising under or by reason of this **Contract**, the **City** shall have the right to require the **Contractor** to produce for examination under oath, up until the trial of the action or hearing before the Contract Dispute Resolution Board, the books and documents described in Article 30.3 and submit itself and all persons in its employ for examination under oath. If this Article 30 is not complied with as required, then the **Contractor** hereby consents to the dismissal of the action or dispute resolution procedure.

CHAPTER VII: POWERS OF THE RESIDENT ENGINEER,THE ENGINEER OR ARCHITECT AND THE COMMISSIONER

ARTICLE 31. THE RESIDENT ENGINEER

31.1 The **Resident Engineer** shall have the power to inspect, supervise, and control the performance of the **Work**, subject to review by the **Commissioner**. The **Resident Engineer** shall not, however, have the power to issue an **Extra Work** order, except as specifically designated in writing by the **Commissioner**.

ARTICLE 32. THE ENGINEER OR ARCHITECT OR PROJECT MANAGER

32.1 The **Engineer** or **Architect** or **Project Manager**, in addition to those matters elsewhere herein delegated to the **Engineer** and expressly made subject to his/her determination, direction or approval, shall have the power, subject to review by the **Commissioner**:

32.1.1 To determine the amount, quality, and location of the **Work** to be paid for hereunder; and

32.1.2 To determine all questions in relation to the **Work**, to interpret the **Contract Drawings**, **Specifications**, and **Addenda**, and to resolve all patent inconsistencies or ambiguities therein; and

32.1.3 To determine how the **Work** of this **Contract** shall be coordinated with **Work** of **Other Contractors** engaged simultaneously on this **Project**, including the power to suspend any part of the **Work**, but not the whole thereof; and

32.1.4 To make minor changes in the **Work** as he/she deems necessary, provided such changes do not result in a net change in the cost to the **City** or to the **Contractor** of the **Work** to be done under the **Contract**; and

32.1.5 To amplify the **Contract Drawings**, add explanatory information and furnish additional **Specifications** and drawings, consistent with this **Contract**.

32.2 The foregoing enumeration shall not imply any limitation upon the power of the **Engineer** or **Architect** or **Project Manager**, for it is the intent of this **Contract** that all of the **Work** shall generally be subject to his/her determination, direction, and approval, except where the determination, direction or approval of someone other than the **Engineer** or **Architect** or **Project Manager** is expressly called for herein.

32.3 The **Engineer** or **Architect** or **Project Manager** shall not, however, have the power to issue an **Extra Work** order, except as specifically designated in writing by the **Commissioner**.

ARTICLE 33. THE COMMISSIONER

33.1 The **Commissioner**, in addition to those matters elsewhere herein expressly made subject to his/her determination, direction or approval, shall have the power:

33.1.1 To review and make determinations on any and all questions in relation to this **Contract** and its performance; and

33.1.2 To modify or change this **Contract** so as to require the performance of **Extra Work** (subject, however, to the limitations specified in Article 25) or the omission of **Contract Work**; and

33.1.3 To suspend the whole or any part of the **Work** whenever in his/her judgment such suspension is required:

33.1.3(a) In the interest of the **City** generally; or

33.1.3(b) To coordinate the **Work** of the various contractors engaged on this **Project** pursuant to the provisions of Article 12; or

33.1.3(c) To expedite the completion of the entire **Project** even though the completion of this particular **Contract** may thereby be delayed.

ARTICLE 34. NO ESTOPPEL

34.1 Neither the **City** nor any **Agency**, official, agent or employee thereof, shall be bound, precluded or estopped by any determination, decision, approval, order, letter, payment or certificate made or given under or in connection with this **Contract** by the **City**, the **Commissioner**, the **Engineer**, the **Resident Engineer**, or any other official, agent or employee of the **City**, either before or after the final completion and acceptance of the **Work** and payment therefor:

34.1.1 From showing the true and correct classification, amount, quality or character of the **Work** actually done; or that any such determination, decision, order, letter, payment or certificate was untrue, incorrect or improperly made in any particular, or that the **Work**, or any part thereof, does not in fact conform to the requirements of this **Contract**; and

34.1.2 From demanding and recovering from the **Contractor** any overpayment made to it, or such damages as the **City** may sustain by reason of the **Contractor's** failure to perform each and every part of its **Contract**.

CHAPTER VIII: LABOR PROVISIONS

ARTICLE 35. EMPLOYEES

35.1 The **Contractor** and its **Subcontractors** shall not employ on the **Work**:

35.1.1 Anyone who is not competent, faithful and skilled in the **Work** for which he/she shall be employed; and whenever the **Commissioner** shall inform the **Contractor**, in writing, that any employee is, in his/her opinion, incompetent, unfaithful or disobedient, that employee shall be discharged from the **Work** forthwith, and shall not again be employed upon it; or

35.1.2 Any labor, materials or means whose employment, or utilization during the course of this **Contract**, may tend to or in any way cause or result in strikes, work stoppages, delays, suspension of **Work** or similar troubles by workers employed by the **Contractor** or its **Subcontractors**, or by any of the trades working in or about the buildings and premises where **Work** is being performed under this **Contract**, or by **Other Contractors** or their **Subcontractors** pursuant to other contracts, or on any other building or premises owned or operated by the **City**, its **Agencies**, departments, boards or authorities. Any violation by the **Contractor** of this requirement may, upon certification of the **Commissioner**, be considered as proper and sufficient cause for declaring the **Contractor** to be in default, and for the **City** to take action against it as set forth in Chapter X of this **Contract**, or such other article of this **Contract** as the Commissioner may deem proper; or

35.1.3 In accordance with Section 220.3-e of the Labor Law of the State of New York (hereinafter "Labor Law"), the **Contractor** and its **Subcontractors** shall not employ on the **Work** any apprentice, unless he/she is a registered individual, under a bona fide program registered with the New York State Department of Labor. The allowable ratio of apprentices to journey-level workers in any craft classification shall not be greater than the ratio permitted to the **Contractor** as to its work force on any job under the registered program. Any employee listed on a payroll at an apprentice wage rate, who is not registered as above, shall be paid the wage rate determined by the **Comptroller** of the **City** for the classification of **Work** actually performed. The **Contractor** or **Subcontractor** will be required to furnish written evidence of the registration of its program and apprentices as well as all the appropriate ratios and wage rates, for the area of the construction prior to using any apprentices on the **Contract Work**.

35.2 If the total cost of the **Work** under this **Contract** is at least two hundred fifty thousand ($250,000) dollars, all laborers, workers, and mechanics employed in the performance of the **Contract** on the public work site, either by the **Contractor**, **Subcontractor** or other person doing or contracting to do the whole or a part of the **Work** contemplated by the **Contract**, shall be certified prior to performing any **Work** as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least ten (10) hours in duration.

35.3 In accordance with Local Law Nos. 30-2012 and 33-2012, codified at sections 6-132 and 12-113 of the Administrative Code, respectively,

35.3.1 The **Contractor** shall not take an adverse personnel action with respect to an officer or employee in retaliation for such officer or employee making a report of information concerning conduct which such officer or employee knows or reasonably believes to involve corruption, criminal activity, conflict of interest, gross mismanagement or abuse of authority by any officer or employee relating to this **Contract** to (a) the Commissioner of the Department of Investigation, (b) a member of the New York City Council, the Public Advocate, or the **Comptroller**, or (c) the **CCPO**, **ACCO**, **Agency** head, or **Commissioner**.

35.3.2 If any of the **Contractor**'s officers or employees believes that he or she has been the subject of an adverse personnel action in violation of Article 35.3.1, he or she shall be entitled to bring a cause of action against the **Contractor** to recover all relief necessary to make him or her whole. Such relief may include but is not limited to: (a) an injunction to restrain continued retaliation, (b) reinstatement to the position such employee would have had but for the retaliation or to an equivalent position, (c) reinstatement of full fringe benefits and seniority rights, (d) payment of two times back

pay, plus interest, and (e) compensation for any special damages sustained as a result of the retaliation, including litigation costs and reasonable attorney's fees.

35.3.3 The **Contractor** shall post a notice provided by the **City** in a prominent and accessible place on any site where work pursuant to the **Contract** is performed that contains information about:

35.3.3(a) how its employees can report to the New York City Department of Investigation allegations of fraud, false claims, criminality or corruption arising out of or in connection with the **Contract**; and

35.3.3(b) the rights and remedies afforded to its employees under Administrative Code sections 7-805 (the New York City False Claims Act) and 12-113 (the Whistleblower Protection Expansion Act) for lawful acts taken in connection with the reporting of allegations of fraud, false claims, criminality or corruption in connection with the **Contract**.

35.3.4 For the purposes of this Article 35.3, "adverse personnel action" includes dismissal, demotion, suspension, disciplinary action, negative performance evaluation, any action resulting in loss of staff, office space, equipment or other benefit, failure to appoint, failure to promote, or any transfer or assignment or failure to transfer or assign against the wishes of the affected officer or employee.

35.3.5 This Article 35.3 is applicable to all of the **Contractor**'s **Subcontractors** having subcontracts with a value in excess of $100,000; accordingly, the **Contractor** shall include this rider in all subcontracts with a value a value in excess of $100,000.

35.4 Article 35.3 is not applicable to this **Contract** if it is valued at $100,000 or less. Articles 35.3.1, 35.3.2, 35.3.4, and 35.3.5 are not applicable to this **Contract** if it was solicited pursuant to a finding of an emergency.

35.5 Paid Sick Leave Law.

35.5.1 Introduction and General Provisions.

35.5.1(a) The Earned Sick Time Act, also known as the Paid Sick Leave Law ("PSLL"), requires covered employees who annually perform more than 80 hours of work in New York City to be provided with paid sick time.[2] Contractors of the **City** or of other governmental entities may be required to provide sick time pursuant to the PSLL.

35.5.1(b) The PSLL became effective on April 1, 2014, and is codified at Title 20, Chapter 8, of the New York City Administrative Code. It is administered by the City's Department of Consumer Affairs ("DCA"); DCA's rules promulgated under the PSLL are codified at Chapter 7 of Title 6 of the Rules of the City of New York ("Rules").

[2] Pursuant to the PSLL, if fewer than five employees work for the same employer, as determined pursuant to New York City Administrative Code § 20-912(g), such employer has the option of providing such employees uncompensated sick time.

35.5.1(c) The **Contractor** agrees to comply in all respects with the PSLL and the Rules, and as amended, if applicable, in the performance of this **Contract**. The **Contractor** further acknowledges that such compliance is a material term of this **Contract** and that failure to comply with the PSLL in performance of this **Contract** may result in its termination.

35.5.1(d) The **Contractor** must notify the **Agency Chief Contracting Officer** of the **Agency** with whom it is contracting in writing within ten (10) days of receipt of a complaint (whether oral or written) regarding the PSLL involving the performance of this **Contract**. Additionally, the **Contractor** must cooperate with DCA's education efforts and must comply with DCA's subpoenas and other document demands as set forth in the PSLL and Rules.

35.5.1(e) The PSLL is summarized below for the convenience of the **Contractor**. The **Contractor** is advised to review the PSLL and Rules in their entirety. On the website www.nyc.gov/PaidSickLeave there are links to the PSLL and the associated Rules as well as additional resources for employers, such as Frequently Asked Questions, timekeeping tools and model forms, and an event calendar of upcoming presentations and webinars at which the **Contractor** can get more information about how to comply with the PSLL. The **Contractor** acknowledges that it is responsible for compliance with the PSLL notwithstanding any inconsistent language contained herein.

35.5.2 Pursuant to the PSLL and the Rules: Applicability, Accrual, and Use.

35.5.2(a) An employee who works within the City of New York for more than eighty hours in any consecutive 12-month period designated by the employer as its "calendar year" pursuant to the PSLL ("Year") must be provided sick time. Employers must provide a minimum of one hour of sick time for every 30 hours worked by an employee and compensation for such sick time must be provided at the greater of the employee's regular hourly rate or the minimum wage. Employers are not required to provide more than 40 hours of sick time to an employee in any Year.

35.5.2(b) An employee has the right to determine how much sick time he or she will use, provided that employers may set a reasonable minimum increment for the use of sick time not to exceed four hours per **Day**. In addition, an employee may carry over up to 40 hours of unused sick time to the following Year, provided that no employer is required to allow the use of more than forty hours of sick time in a Year or carry over unused paid sick time if the employee is paid for such unused sick time and the employer provides the employee with at least the legally required amount of paid sick time for such employee for the immediately subsequent Year on the first **Day** of such Year.

35.5.2(c) An employee entitled to sick time pursuant to the PSLL may use sick time for any of the following:

i. such employee's mental illness, physical illness, injury, or health condition or the care of such illness, injury, or condition or such employee's need for medical diagnosis or preventive medical care;
ii. such employee's care of a family member (an employee's child, spouse, domestic partner, parent, sibling, grandchild or grandparent, or the child or parent of an employee's spouse or domestic partner) who has a mental

illness, physical illness, injury or health condition or who has a need for medical diagnosis or preventive medical care;

iii. closure of such employee's place of business by order of a public official due to a public health emergency; or

iv. such employee's need to care for a child whose school or childcare provider has been closed due to a public health emergency.

35.5.2(d) An employer must not require an employee, as a condition of taking sick time, to search for a replacement. However, an employer may require an employee to provide: reasonable notice of the need to use sick time; reasonable documentation that the use of sick time was needed for a reason above if for an absence of more than three consecutive work days; and/or written confirmation that an employee used sick time pursuant to the PSLL. However, an employer may not require documentation specifying the nature of a medical condition or otherwise require disclosure of the details of a medical condition as a condition of providing sick time and health information obtained solely due to an employee's use of sick time pursuant to the PSLL must be treated by the employer as confidential.

35.5.2(e) If an employer chooses to impose any permissible discretionary requirement as a condition of using sick time, it must provide to all employees a written policy containing those requirements, using a delivery method that reasonably ensures that employees receive the policy. If such employer has not provided its written policy, it may not deny sick time to an employee because of non-compliance with such a policy.

35.5.2(f) Sick time to which an employee is entitled must be paid no later than the payday for the next regular payroll period beginning after the sick time was used.

35.5.3 Exemptions and Exceptions. Notwithstanding the above, the PSLL does not apply to any of the following:

35.5.3(a) an independent contractor who does not meet the definition of employee under section 190(2) of the New York State Labor Law;

35.5.3(b) an employee covered by a valid collective bargaining agreement in effect on April 1, 2014, until the termination of such agreement;

35.5.3(c) an employee in the construction or grocery industry covered by a valid collective bargaining agreement if the provisions of the PSLL are expressly waived in such collective bargaining agreement;

35.5.3(d) an employee covered by another valid collective bargaining agreement if such provisions are expressly waived in such agreement and such agreement provides a benefit comparable to that provided by the PSLL for such employee;

35.5.3(e) an audiologist, occupational therapist, physical therapist, or speech language pathologist who is licensed by the New York State Department of Education and who calls in for work assignments at will, determines his or her own schedule, has the ability to reject or accept any assignment referred to him or her, and is paid an average hourly wage that is at least four times the federal minimum wage;

35.5.3(f) an employee in a work study program under Section 2753 of Chapter 42 of the United States Code;

35.5.3(g) an employee whose work is compensated by a qualified scholarship program as that term is defined in the Internal Revenue Code, Section 117 of Chapter 20 of the United States Code; or

35.5.3(h) a participant in a Work Experience Program (WEP) under section 336-c of the New York State Social Services Law.

35.5.4 Retaliation Prohibited. An employer may not threaten or engage in retaliation against an employee for exercising or attempting in good faith to exercise any right provided by the PSLL. In addition, an employer may not interfere with any investigation, proceeding, or hearing pursuant to the PSLL.

35.5.5 Notice of Rights.

35.5.5(a) An employer must provide its employees with written notice of their rights pursuant to the PSLL. Such notice must be in English and the primary language spoken by an employee, provided that DCA has made available a translation into such language. Downloadable notices are available on DCA's website at http://www.nyc.gov/html/dca/html/law/PaidSickLeave.shtml.

35.5.5(b) Any person or entity that willfully violates these notice requirements is subject to a civil penalty in an amount not to exceed fifty dollars for each employee who was not given appropriate notice.

35.5.6 Records. An employer must retain records documenting its compliance with the PSLL for a period of at least three years, and must allow DCA to access such records in furtherance of an investigation related to an alleged violation of the PSLL.

35.5.7 Enforcement and Penalties.

35.5.7(a) Upon receiving a complaint alleging a violation of the PSLL, DCA has the right to investigate such complaint and attempt to resolve it through mediation. Within 30 **Days** of written notification of a complaint by DCA, or sooner in certain circumstances, the employer must provide DCA with a written response and such other information as DCA may request. If DCA believes that a violation of the PSLL has occurred, it has the right to issue a notice of violation to the employer.

35.5.7(b) DCA has the power to grant an employee or former employee all appropriate relief as set forth in New York City Administrative Code § 20-924(d). Such relief may include, among other remedies, treble damages for the wages that should have been paid, damages for unlawful retaliation, and damages and reinstatement for unlawful discharge. In addition, DCA may impose on an employer found to have violated the PSLL civil penalties not to exceed $500 for a first violation, $750 for a second violation within two years of the first violation, and $1,000 for each succeeding violation within two years of the previous violation.

35.5.8 More Generous Polices and Other Legal Requirements. Nothing in the PSLL is intended to discourage, prohibit, diminish, or impair the adoption or retention of a more generous sick time policy, or the obligation of an employer to comply with any contract,

collective bargaining agreement, employment benefit plan or other agreement providing more generous sick time. The PSLL provides minimum requirements pertaining to sick time and does not preempt, limit or otherwise affect the applicability of any other law, regulation, rule, requirement, policy or standard that provides for greater accrual or use by employees of sick leave or time, whether paid or unpaid, or that extends other protections to employees. The PSLL may not be construed as creating or imposing any requirement in conflict with any federal or state law, rule or regulation.

35.6 HireNYC: Hiring and Reporting Requirements. This Article 35.6 applies to construction contracts of $1,000,000 or more. The **Contractor** shall comply with the requirements of Articles 35.6.1-35.6.5 for all non-trades jobs (e.g., for an administrative position arising out of **Work** ant located in New York City). The **Contractor** shall reasonably cooperate with SBS and the **City** on specific outreach events, including "Hire-on-the-Spot" events, for the hiring of trades workers in connection with the **Work**. If provided elsewhere in this **Contract**, this **Contract** is subject to a project labor agreement.

35.6.1 Enrollment. The **Contractor** shall enroll with the HireNYC system, found at www.nyc.gov/sbs, within thirty (30) days after the registration of this **Contract** pursuant to Section 328 of the New York City Charter. The **Contractor** shall provide information about the business, designate a primary contact and say whether it intends to hire for any entry to mid-level job opportunities arising from this **Contract** and located in New York City, and, if so, the approximate start date of the first hire.

35.6.2 Job Posting Requirements.

35.6.2(a) Once enrolled in HireNYC, the **Contractor** agrees to update the HireNYC portal with all entry to mid-level job opportunities arising from this **Contract** and located in New York City, if any, which shall be defined as jobs requiring no more than an associate degree, as provided by the New York State Department of Labor (see Column F of https://labor.ny.gov/stats/2012-2022- NYS-Employment-Prospects.xls). The information to be updated includes the types of entry and mid-level positions made available from the work arising from the **Contract** and located in New York City, the number of positions, the anticipated schedule of initiating the hiring process for these positions, and the contact information for the **Contractor's** representative charged with overseeing hiring. The **Contractor** must update the HireNYC portal with any hiring needs arising from the contract and located in New York City, and the requirements of the jobs to be filled, no less than three weeks prior to the intended first day of employment for each new position, except with the permission of SBS, not to be unreasonably withheld, and must also update the HireNYC portal as set forth below.

35.6.2(b) After enrollment through HireNYC and submission of relevant information, SBS will work with the **Contractor** to develop a recruitment plan which will outline the candidate screening process, and will provide clear instructions as to when, where, and how interviews will take place. HireNYC will screen applicants based on employer requirements and refer applicants whom it believes are qualified to the **Contractor** for interviews. The **Contractor** must interview referred applicants whom it believes are qualified.

35.6.2(c) After completing an interview of a candidate referred by HireNYC, the **Contractor** must provide feedback via the portal within twenty (20) business days to indicate which candidates were interviewed and hired, if any. In addition, the **Contractor** shall provide the start date of new hires, and additional information

reasonably related to such hires, within twenty (20) business days after the start date. In the event the **Contractor** does not have any job openings covered by this Rider in any given year, the **Contractor** shall be required to provide an annual update to HireNYC to that effect. For this purpose, the reporting year shall run from the date of the registration of the **Contract** pursuant to Charter section 328 and each anniversary date.

35.6.2(d) These requirements do not limit the **Contractor's** ability to assess the qualifications of prospective workers, and to make final hiring and retention decisions. No provision of this Article 35.6 shall be interpreted so as to require the **Contractor** to employ any particular worker.

35.6.2(e) In addition, the provisions of this Article 35.6 shall not apply to positions that the **Contractor** intends to fill with employees employed pursuant to the job retention provision of Section 22-505 of the Administrative Code of the City of New York. The **Contractor** shall not be required to report such openings with HireNYC. However, the **Contractor** shall enroll with the HireNYC system pursuant to Article 35.6.1, above, and, if such positions subsequently become open, then the remaining provisions of this Article 35.6 will apply.

35.6.3 Breach and Liquidated Damages. If the **Contractor** fails to comply with the terms of the **ContrSact** and this Article 35.6 (l) by not enrolling its business with HireNYC; (2) by not informing HireNYC, as required, of open positions; or (3) by failing to interview a qualified candidate, the **Agency** may assess liquidated damages in the amount of two-thousand five hundred dollars ($2,500) per breach. For all other events of noncompliance with the terms of this Article 35.6, the **Agency** may assess liquidated damages in the amount of five hundred dollars ($500) per breach. Furthermore, in the event the **Contractor** breaches the requirements of this Article 35.6 during the term of the **Contract**, the **City** may hold the **Contractor** in default of this **Contract**.

35.6.4 Audit Compliance. In addition to the auditing requirements set forth in other parts of the **Contract**, the **Contractor** shall permit SBS and the **City** to inspect any and all records concerning or relating to job openings or the hiring of individuals for work arising from the **Contract** and located in New York City. The **Contractor** shall permit an inspection within seven (7) business days of the request.

35.6.5 Other Reporting Requirements. The **Contractor** shall report to the **City**, on a monthly basis, all information reasonably requested by the **City** that is necessary for the **City** to comply with any reporting requirements imposed by **Law**, including any requirement that the **City** maintain a publicly accessible database. In addition, the **Contractor** agrees to comply with all reporting requirements imposed by **Law**, or as otherwise requested by the **City**.

35.6.6 Federal Hiring Requirements. If this **Contract** is federally funded (as indicated elsewhere in this Contract), the **Contractor** shall comply with all federal hiring requirements as may be set forth in this **Contract**, including, as applicable: (a) Section 3 of the HUD Act of 1968, which requires, to the greatest extent feasible, economic opportunities for 30 percent of new hires be given to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing and Executive Order 11246, which prohibits discrimination in employment due to race, color, religion, sex or national origin, and requires the implementation of goals for minority and female participation for work involving any construction trade.

ARTICLE 36. NO DISCRIMINATION

36.1 The **Contractor** specifically agrees, as required by Labor Law Section 220-e, as amended, that:

36.1.1 In the hiring of employees for the performance of **Work** under this **Contract** or any subcontract hereunder, neither the **Contractor**, **Subcontractor**, nor any person acting on behalf of such **Contractor** or **Subcontractor**, shall by reason of race, creed, color or national origin discriminate against any citizen of the State of New York who is qualified and available to perform the **Work** to which the employment relates;

36.1.2 Neither the **Contractor**, **Subcontractor**, nor any person on its behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of **Work** under this **Contract** on account of race, creed, color or national origin;

36.1.3 There may be deducted from the amount payable to the **Contractor** by the **City** under this **Contract** a penalty of fifty ($50.00) dollars for each person for each **Day** during which such person was discriminated against or intimidated in violation of the provisions of this **Contract**; and

36.1.4 This **Contract** may be cancelled or terminated by the **City** and all moneys due or to become due hereunder may be forfeited, for a second or any subsequent violation of the terms or conditions of this Article 36.

36.1.5 This Article 36 covers all construction, alteration and repair of any public building or public work occurring in the State of New York and the manufacture, sale, and distribution of materials, equipment, and supplies to the extent that such operations are performed within the State of New York pursuant to this **Contract**.

36.2 The **Contractor** specifically agrees, as required by Section 6-108 of the Administrative Code, as amended, that:

36.2.1 It shall be unlawful for any person engaged in the construction, alteration or repair of buildings or engaged in the construction or repair of streets or highways pursuant to a **Contract** with the **City** or engaged in the manufacture, sale or distribution of materials, equipment or supplies pursuant to a **Contract** with the **City** to refuse to employ or to refuse to continue in any employment any person on account of the race, color or creed of such person.

36.2.2 It shall be unlawful for any person or any servant, agent or employee of any person, described in Article 36.1.2, to ask, indicate or transmit, orally or in writing, directly or indirectly, the race, color or creed or religious affiliation of any person employed or seeking employment from such person, firm or corporation.

36.2.3 Breach of the foregoing provisions shall be deemed a violation of a material provision of this **Contract**.

36.2.4 Any person, or the employee, manager or owner of or officer of such firm or corporation who shall violate any of the provisions of this Article 36.2 shall, upon

conviction thereof, be punished by a fine of not more than one hundred ($100.00) dollars or by imprisonment for not more than thirty (30) **Days**, or both.

36.3 This **Contract** is subject to the requirements of Executive Order No. 50 (1980) ("E.O. 50"), as revised, and the rules and regulations promulgated thereunder. No contract will be awarded unless and until these requirements have been complied with in their entirety. By signing this **Contract**, the **Contractor** agrees that it:

36.3.1 Will not engage in any unlawful discrimination against any employee or applicant for employment because of race, creed, color, national origin, sex, age, disability, marital status or sexual orientation with respect to all employment decisions including, but not limited to, recruitment, hiring, upgrading, demotion, downgrading, transfer, training, rates of pay or other forms of compensation, layoff, termination, and all other terms and conditions of employment; and

36.3.2 Will not engage in any unlawful discrimination in the selection of **Subcontractors** on the basis of the owner's race, color, creed, national origin, sex, age, disability, marital status or sexual orientation; and

36.3.3 Will state in all solicitations or advertisements for employees placed by or on behalf of the **Contractor** that all qualified applicants will receive consideration for employment without unlawful discrimination based on race, creed, color, national origin, sex, age, citizens status, disability, marital status, sexual orientation, or that it is an equal employment opportunity employer; and

36.3.4 Will send to each labor organization or representative of workers with which it has a collective bargaining agreement or other contract or memorandum of understanding, written notification of its equal employment opportunity commitments under E.O. 50 and the rules and regulations promulgated thereunder; and

36.3.5 Will furnish, before the award of the **Contract**, all information and reports, including an employment report, that are required by E.O. 50, the rules and regulations promulgated thereunder, and orders of the **City** Department of Business Services, Division of Labor Services (**DLS**) and will permit access to its books, records, and accounts by the **DLS** for the purposes of investigation to ascertain compliance with such rules, regulations, and orders.

36.4 The **Contractor** understands that in the event of its noncompliance with the nondiscrimination clauses of this **Contract** or with any of such rules, regulations, or orders, such noncompliance shall constitute a material breach of this **Contract** and noncompliance with E.O. 50 and the rules and regulations promulgated thereunder. After a hearing held pursuant to the rules of the **DLS**, the Director of the **DLS** may direct the **Commissioner** to impose any or all of the following sanctions:

36.4.1 Disapproval of the **Contractor**; and/or

36.4.2 Suspension or termination of the **Contract**; and/or

36.4.3 Declaring the **Contractor** in default; and/or

36.4.4 In lieu of any of the foregoing sanctions, the Director of the **DLS** may impose an employment program.

In addition to any actions taken under this **Contract**, failure to comply with E.O. 50 and the rules and regulations promulgated thereunder, in one or more instances, may result in a **City Agency** declaring the **Contractor** to be non-responsible in future procurements. The **Contractor** further agrees that it will refrain from entering into any **Contract** or **Contract** modification subject to E.O. 50 and the rules and regulations promulgated thereunder with a **Subcontractor** who is not in compliance with the requirements of E.O. 50 and the rules and regulations promulgated thereunder.

36.5 The **Contractor** specifically agrees, as required by Section 6-123 of the Administrative Code, that:

36.5.1 The **Contractor** will not engage in any unlawful discriminatory practice in violation of Title 8 of the Administrative Code; and

36.5.2 Any failure to comply with this Article 36.5 may subject the **Contractor** to the remedies set forth in Section 6-123 of the Administrative Code, including, where appropriate, sanctions such as withholding of payment, imposition of an employment program, finding the **Contractor** to be in default, cancellation of the **Contract**, or any other sanction or remedy provided by **Law** or **Contract**.

ARTICLE 37. LABOR LAW REQUIREMENTS

37.1 The **Contractor** shall strictly comply with all applicable provisions of the Labor Law, as amended. Such compliance is a material term of this **Contract**.

37.2 The **Contractor** specifically agrees, as required by Labor Law Sections 220 and 220-d, as amended, that:

37.2.1 Hours of **Work**: No laborer, worker, or mechanic in the employ of the **Contractor**, **Subcontractor** or other person doing or contracting to do the whole or a part of the **Work** contemplated by this **Contract** shall be permitted or required to work more than eight (8) hours in any one (1) **Day**, or more than five (5) **Days** in any one (1) week, except as provided in the Labor Law and in cases of extraordinary emergency including fire, flood, or danger to life or property, or in the case of national emergency when so proclaimed by the President of the United States of America.

37.2.2 In situations in which there are not sufficient laborers, workers, and mechanics who may be employed to carry on expeditiously the **Work** contemplated by this **Contract** as a result of such restrictions upon the number of hours and **Days** of labor, and the immediate commencement or prosecution or completion without undue delay of the **Work** is necessary for the preservation of the **Site** and/or for the protection of the life and limb of the persons using the same, such laborers, workers, and mechanics shall be permitted or required to work more than eight (8) hours in any one (1) **Day**; or five (5) **Days** in any one (1) week; provided, however, that upon application of any **Contractor**, the **Commissioner** shall have first certified to the Commissioner of Labor of the State of New York (hereinafter "Commissioner of Labor") that such public **Work** is of an important nature and that a delay in carrying it to completion would result in serious disadvantage to the public; and provided, further, that such Commissioner of Labor shall have determined that such an emergency does in fact exist as provided in Labor Law Section 220.2.

37.2.3 Failure of the **Commissioner** to make such a certification to the Commissioner of Labor shall not entitle the **Contractor** to damages for delay or for any cause whatsoever.

37.2.4 Prevailing Rate of Wages: The wages to be paid for a legal day's **Work** to laborers, workers, or mechanics employed upon the **Work** contemplated by this **Contract** or upon any materials to be used thereon shall not be less than the "prevailing rate of wage" as defined in Labor Law Section 220, and as fixed by the **Comptroller** in the attached Schedule of Wage Rates and in updated schedules thereof. The prevailing wage rates and supplemental benefits to be paid are those in effect at the time the **Work** is being performed.

37.2.5 Requests for interpretation or correction in the Information for Bidders includes all requests for clarification of the classification of trades to be employed in the performance of the **Work** under this **Contract**. In the event that a trade not listed in the **Contract** is in fact employed during the performance of this **Contract**, the **Contractor** shall be required to obtain from the **Agency** the prevailing wage rates and supplementary benefits for the trades used and to complete the performance of this **Contract** at the price at which the **Contract** was awarded.

37.2.6 Minimum Wages: Except for employees whose wage is required to be fixed pursuant to Labor Law Section 220, all persons employed by the **Contractor** and any **Subcontractor** in the manufacture or furnishing of the supplies, materials, or equipment, or the furnishing of work, labor, or services, used in the performance of this **Contract**, shall be paid, without subsequent deduction or rebate unless expressly authorized by **Law**, not less than the sum mandated by **Law**.

37.3 Working Conditions: No part of the **Work**, labor or services shall be performed or rendered by the **Contractor** in any plants, factories, buildings or surroundings or under working conditions which are unsanitary or hazardous or dangerous to the health and safety of employees engaged in the performance of this **Contract**. Compliance with the safety, sanitary, and factory inspection **Laws** of the state in which the **Work** is to be performed shall be prima facie evidence of compliance with this Article 37.3.

37.4 Prevailing Wage Enforcement: The **Contractor** agrees to pay for all costs incurred by the **City** in enforcing prevailing wage requirements, including the cost of any investigation conducted by or on behalf of the **Agency** or the **Comptroller,** where the **City** discovers a failure to comply with any of the requirements of this Article 37 by the **Contractor** or its **Subcontractor(s)**. The **Contractor** also agrees that, should it fail or refuse to pay for any such investigation, the **Agency** is hereby authorized to deduct from a **Contractor's** account an amount equal to the cost of such investigation.

37.4.1 The Labor Law Section 220 and Section 220-d, as amended, provide that this **Contract** shall be forfeited and no sum paid for any **Work** done hereunder on a second conviction for willfully paying less than:

37.4.1(a) The stipulated prevailing wage scale as provided in Labor Law section 220, as amended, or

37.4.1(b) The stipulated minimum hourly wage scale as provided in Labor Law section 220-d, as amended.

37.4.2 For any breach or violation of either working conditions (Article 37.3) or minimum wages (Article 37.2.6) provisions, the party responsible therefor shall be liable to the **City** for liquidated damages, which may be withheld from any amounts due on any contracts with the **City** of such party responsible, or may be recovered in actions brought by the **City**

Corporation Counsel in the name of the **City**, in addition to damages for any other breach of this **Contract**, for a sum equal to the amount of any underpayment of wages due to any employee engaged in the performance of this **Contract**. In addition, the **Commissioner** shall have the right to cancel contracts and enter into other contracts for the completion of the original contract, with or without public letting, and the original **Contractor** shall be liable for any additional cost. All sums withheld or recovered as deductions, rebates, refunds, or underpayment of wages hereunder, shall be held in a special deposit account and shall be paid without interest, on order of the **Comptroller**, directly to the employees who have been paid less than minimum rates of pay as set forth herein and on whose account such sums were withheld or recovered, provided that no claims by employees for such payments shall be entertained unless made within two (2) years from the date of actual notice to the **Contractor** of the withholding or recovery of such sums by the **City**.

37.4.3 A determination by the **Comptroller** that a **Contractor** and/or its **Subcontractor** willfully violated Labor Law Section 220 will be forwarded to the **City's** five District Attorneys for review.

37.4.4 The **Contractor's** or **Subcontractor's** noncompliance with this Article 37.4 and Labor Law Section 220 may result in an unsatisfactory performance evaluation and the **Comptroller** may also find and determine that the **Contractor** or **Subcontractor** willfully violated the New York Labor **Law**.

37.4.4(a) An unsatisfactory performance evaluation for noncompliance with this Article 37.4 may result in a determination that the **Contractor** is a non-responsible bidder on subsequent procurements with the **City** and thus a rejection of a future award of a contract with the **City**, as well as any other sanctions provided for by **Law**.

37.4.4(b) Labor Law Section 220-b, as amended, provides that when two (2) final determinations have been rendered against a **Contractor** or **Subcontractor** within any consecutive six (6) year period determining that such **Contractor** or **Subcontractor** has willfully failed to pay the prevailing rate of wages or to provide supplements in accordance with the Labor Law and this Article 37.4, whether such failures were concurrent or consecutive and whether or not such final determinations concerning separate public works projects are rendered simultaneously, such **Contractor** or **Subcontractor** shall be ineligible to submit a bid on or be awarded any public works contract with the **City** for a period of five (5) years from the second final determination. If the final determination involves the falsification of payroll records or the kickback of wages or supplements, the **Contractor** or **Subcontractor** shall be ineligible to submit a bid on or be awarded any public works contract with the **City** for a period of five (5) years from the first final determination.

37.4.4(c) Labor Law Section 220, as amended, provides that the **Contractor** or **Subcontractor** found to have violated this Article 37.4 may be directed to make payment of wages or supplements including interest found to be due, and the **Contractor** or **Subcontractor** may be directed to make payment of a further sum as a civil penalty in an amount not exceeding twenty-five (25%) percent of the total amount found to be due.

37.5 The **Contractor** and its **Subcontractors** shall within ten (10) **Days** after mailing of a Notice of Award or written order, post in prominent and conspicuous places in each and every plant, factory, building, and structure where employees of the **Contractor** and its **Subcontractors** engaged in the

performance of this **Contract** are employed, notices furnished by the **City**, in relation to prevailing wages and supplements, minimum wages, and other stipulations contained in Sections 220 and 220-h of the Labor Law, and the **Contractor** and its **Subcontractors** shall continue to keep such notices posted in such prominent and conspicuous places until **Final Acceptance** of the supplies, materials, equipment, or **Work**, labor, or services required to be furnished or rendered under this **Contract**.

37.6 The **Contractor** shall strictly comply with all of the provisions of Articles 37.6.1 through 37.6.5, and provide for all workers, laborers or mechanics in its employ, the following:

37.6.1 Notices Posted At **Site**: Post, in a location designated by the **City**, schedules of prevailing wages and supplements for this **Project**, a copy of all re-determinations of such schedules for the **Project**, the Workers' Compensation **Law** Section 51 notice, all other notices required by **Law** to be posted at the **Site**, the **City** notice that this **Project** is a public works project on which each worker is entitled to receive the prevailing wages and supplements for the occupation at which he or she is working, and all other notices which the **City** directs the **Contractor** to post. The **Contractor** shall provide a surface for such notices which is satisfactory to the **City**. The **Contractor** shall maintain and keep current such notices in a legible manner and shall replace any notice or schedule which is damaged, defaced, illegible or removed for any reason. The **Contractor** shall post such notices before commencing any **Work** on the **Site** and shall maintain such notices until all **Work** on the **Site** is complete; and

37.6.2 Daily **Site** Sign-in Sheets: Maintain daily **Site** sign-in sheets, and require that **Subcontractors** maintain daily **Site** sign-in sheets for its employees, which include blank spaces for an employee's name to be both printed and signed, job title, date started and Social Security number, the time the employee began work and the time the employee left work, until **Final Acceptance** of the supplies, materials, equipment, or **Work**, labor, or services to be furnished or rendered under this **Contract** unless exception is granted by the **Comptroller** upon application by the **Agency**. In the alternative, subject to the approval of the **CCPO**, the **Contractor** and **Subcontractor** may maintain an electronic or biometric sign-in system, which provides the information required by this Article 37.6.2; and

37.6.3 Individual Employee Information Notices: Distribute a notice to each worker, laborer or mechanic employed under this **Contract**, in a form provided by the **Agency**, that this **Project** is a public works project on which each worker, laborer or mechanic is entitled to receive the prevailing rate of wages and supplements for the occupation at which he or she is working. If the total cost of the **Work** under this **Contract** is at least two hundred fifty thousand ($250,000) dollars, such notice shall also include a statement that each worker, laborer or mechanic must be certified prior to performing any **Work** as having successfully completed a course in construction safety and health approved by the United States Department of Labor's Occupational Safety and Health Administration that is at least ten (10) hours in duration. Such notice shall be distributed to each worker before he or she starts performing any **Work** of this **Contract** and with the first paycheck after July first of each year. "Worker, laborer or mechanic" includes employees of the **Contractor** and all **Subcontractors** and all employees of suppliers entering the **Site**. At the time of distribution, the **Contractor** shall have each worker, laborer or mechanic sign a statement, in a form provided by the **Agency**, certifying that the worker has received the notice required by this Article 37.6.3, which signed statement shall be maintained with the payroll records required by this **Contract**; and

37.6.3(a) The **Contractor** and each **Subcontractor** shall notify each worker, laborer or mechanic employed under this **Contract** in writing of the prevailing rate of

wages for their particular job classification. Such notification shall be given to every worker, laborer, and mechanic on their first pay stub and with every pay stub thereafter; and

37.6.4 **Site** Laminated Identification Badges: The **Contractor** shall provide laminated identification badges which include a photograph of the worker's, laborer's or mechanic's face and indicate the worker's, laborer's or mechanic's name, trade, employer's name, and employment starting date (month/day/year). Further, the **Contractor** shall require as a condition of employment on the **Site**, that each and every worker, laborer or mechanic wear the laminated identification badge at all times and that it may be seen by any representative of the **City**. The **Commissioner** may grant a written waiver from the requirement that the laminated identification badge include a photograph if the **Contractor** demonstrates that the identity of an individual wearing a laminated identification badge can be easily verified by another method; and

37.6.5 Language Other Than English Used On **Site**: Provide the **ACCO** notice when three (3) or more employees (worker and/or laborer and/or mechanic) on the **Site**, at any time, speak a language other than English. The **ACCO** will then provide the **Contractor** the notices described in Article 37.6.1 in that language or languages as may be required. The **Contractor** is responsible for all distributions under this Article 37; and

37.6.6 Provision of Records: The **Contractor** and **Subcontractor(s)** shall produce within five (5) **Days** on the **Site** of the **Work** and upon a written order of the **Engineer**, the **Commissioner**, the **ACCO**, the **Agency EAO**, or the **Comptroller,** such records as are required to be kept by this Article 37.6; and

37.6.7 The **Contractor** and **Subcontractor(s)** shall pay employees by check or direct deposit. If this **Contract** is for an amount greater than one million ($1,000,000) dollars, checks issued by the **Contractor** to covered employees shall be generated by a payroll service or automated payroll system (an in-house system may be used if approved by the **Agency**). For any subcontract for an amount greater than seven hundred fifty thousand ($750,000) dollars, checks issued by a **Subcontractor** to covered employees shall be generated by a payroll service or automated payroll system (an in-house system may be used if approved by the **Agency**); and

37.6.8 The failure of the **Contractor** or **Subcontractor(s)** to comply with the provisions of Articles 37.6.1 through 37.6.7 may result in the **Commissioner** declaring the **Contractor** in default and/or the withholding of payments otherwise due under the **Contract**.

37.7 The **Contractor** and its **Subcontractors** shall keep such employment and payroll records as are required by Section 220 of the Labor Law. The failure of the **Contractor** or **Subcontractor(s)** to comply with the provisions of this Article 37.7 may result in the **Commissioner** declaring the **Contractor** in default and/or the withholding of payments otherwise due under the **Contract.**

37.8 At the time the **Contractor** makes application for each partial payment and for final payment, the **Contractor** shall submit to the **Commissioner** a written payroll certification, in the form provided by this **Contract**, of compliance with the prevailing wage, minimum wage, and other provisions and stipulations required by Labor Law Section 220 and of compliance with the training requirements of Labor Law Section 220-h set forth in Article 35.2. This certification of compliance shall be a condition precedent to payment and no payment shall be made to the **Contractor** unless and until each such certification shall have been submitted to and received by the **Commissioner**.

37.9 This **Contract** is executed by the **Contractor** with the express warranty and representation that the **Contractor** is not disqualified under the provisions of Section 220 of the Labor Law from the award of the **Contract**.

37.10 Any breach or violation of any of the foregoing shall be deemed a breach or violation of a material provision of this **Contract**, and grounds for cancellation thereof by the **City**.

ARTICLE 38. PAYROLL REPORTS

38.1 The **Contractor** and its **Subcontractor(s)** shall maintain on the **Site** during the performance of the **Work** the original payrolls or transcripts thereof which the **Contractor** and its **Subcontractor(s)** are required to maintain and shall submit such original payrolls or transcripts, subscribed and affirmed by it as true, within thirty (30) **Days** after issuance of its first payroll, and every thirty (30) **Days** thereafter, pursuant to Labor Law Section 220(3-a)(a)(iii). The **Contractor** and **Subcontractor(s)** shall submit such original payrolls or transcripts along with each and every payment requisition. If payment requisitions are not submitted at least once a month, the **Contractor** and its **Subcontractor(s)** shall submit original payrolls and transcripts both along with its payment requisitions and independently of its payment requisitions.

38.2 The **Contractor** shall maintain payrolls or transcripts thereof for six (6) years from the date of completion of the **Work** on this **Contract**. If such payrolls and transcripts are maintained outside of New York City after the completion of the **Work** and their production is required pursuant to this Article 38, the **Contractor** shall produce such records in New York City upon request by the City.

38.3 The **Contractor** and **Subcontractor(s)** shall comply with any written order, direction, or request made by the **Engineer**, the **Commissioner**, the **ACCO**, the **Agency EAO**, the **Agency Labor Law Investigator(s)**, or the **Comptroller**, to provide to the requesting party any of the following information and/or records within five (5) **Days** of such written order, direction, or request:

38.3.1 Such original payrolls or transcripts thereof subscribed and affirmed by it as true and the statements signed by each worker pursuant to this Chapter VIII; and/or

38.3.2 Attendance sheets for each **Day** on which any employee of the **Contractor** and/or any of the **Subcontractor(s)** performed **Work** on the **Site**, which attendance sheet shall be in a form acceptable to the **Agency** and shall provide information acceptable to the **Agency** to identify each such employee; and/or

38.3.3 Any other information to satisfy the **Engineer**, the **Commissioner**, the **ACCO**, the **Agency EAO**, the **Agency Labor Law Investigator(s)** or the **Comptroller**, that this Chapter VIII and the Labor Law, as to the hours of employment and prevailing rates of wages and/or supplemental benefits, are being observed.

38.4 The failure of the **Contractor** or **Subcontractor(s)** to comply with the provisions of Articles 38.1 and/or 38.2 may result in the **Commissioner** declaring the **Contractor** in default and/or the withholding of payments otherwise due under the **Contract**.

ARTICLE 39. DUST HAZARDS

39.1 Should a harmful dust hazard be created in performing the **Work** of this **Contract**, for the elimination of which appliances or methods have been approved by the Board of Standards and Appeals

of the City of New York, such appliances and methods shall be installed, maintained, and effectively operated during the continuance of such harmful dust hazard. Failure to comply with this provision after notice shall make this **Contract** voidable at the sole discretion of the **City**.

CHAPTER IX: PARTIAL AND FINAL PAYMENTS

ARTICLE 40. CONTRACT PRICE

40.1 The **City** shall pay, and the **Contractor** agrees to accept, in full consideration for the **Contractor's** performance of the **Work** subject to the terms and conditions hereof, the lump sum price or unit prices for which this **Contract** was awarded, plus the amount required to be paid for any **Extra Work** ordered by the **Commissioner** under Article 25, less credit for any **Work** omitted pursuant to Article 29.

ARTICLE 41. BID BREAKDOWN ON LUMP SUM

41.1 Within fifteen (15) **Days** after the commencement date specified in the **Notice to Proceed** or **Order to Work**, unless otherwise directed by the **Resident Engineer**, the **Contractor** shall submit to the **Resident Engineer** a breakdown of its bid price, or of lump sums bid for items of the **Contract**, showing the various operations to be performed under the **Contract**, as directed in the progress schedule required under Article 9, and the value of each of such operations, the total of such items to equal the lump sum price bid. Said breakdown must be approved in writing by the **Resident Engineer**.

41.2 No partial payment will be approved until the **Contractor** submits a bid breakdown that is acceptable to the **Resident Engineer**.

41.3 The **Contractor** shall also submit such other information relating to the bid breakdown as directed by the **Resident Engineer**. Thereafter, the breakdown may be used only for checking the **Contractor's** applications for partial payments hereunder, but shall not be binding upon the **City**, the **Commissioner**, or the **Engineer** for any purpose whatsoever.

ARTICLE 42. PARTIAL PAYMENTS

42.1 From time to time as the **Work** progresses satisfactorily, but not more often than once each calendar month (except where the **Commissioner** approves in writing the submission of invoices on a more frequent basis and for invoices relating to **Work** performed pursuant to a change order), the **Contractor** may submit to the **Engineer** a requisition for a partial payment in the prescribed form, which shall contain an estimate of the quantity and the fair value of the **Work** done during the payment period.

42.2 Partial payments may be made for materials, fixtures, and equipment in advance of their actual incorporation in the **Work**, as the **Commissioner** may approve, and upon the terms and conditions set forth in the General Conditions.

42.3 The **Contractor** shall also submit to the **Commissioner** in connection with every application for partial payment a verified statement in the form prescribed by the **Comptroller** setting forth the information required under Labor Law Section 220-a.

42.4 Within thirty (30) **Days** after receipt of a satisfactory payment application, and within sixty (60) **Days** after receipt of a satisfactory payment application in relation to **Work** performed pursuant to a change order, the **Engineer** will prepare and certify, and the **Commissioner** will approve, a voucher for a partial payment in the amount of such approved estimate, less any and all deductions authorized to be made by the **Commissioner** under the terms of this **Contract** or by **Law**.

ARTICLE 43. PROMPT PAYMENT

43.1 The Prompt Payment provisions of the **PPB** Rules in effect at the time of the bid will be applicable to payments made under this **Contract**. The provisions require the payment to the **Contractor** of interest on payments made after the required payment date, except as set forth in the **PPB** Rules.

43.2 The **Contractor** shall submit a proper invoice to receive payment, except where the **Contract** provides that the **Contractor** will be paid at predetermined intervals without having to submit an invoice for each scheduled payment.

43.3 Determination of interest due will be made in accordance with the **PPB** Rules.

43.4 If the **Contractor** is paid interest, the proportionate share(s) of that interest shall be forwarded by the **Contractor** to its **Subcontractor(s)**.

43.5 The **Contractor** shall pay each **Subcontractor** or **Materialman** not later than seven (7) **Days** after receipt of payment out of amounts paid to the **Contractor** by the **City** for **Work** performed by the **Subcontractor** or **Materialman** under this **Contract**.

> 43.5.1 If **Contractor** fails to make any payment to any **Subcontractor** or **Materialman** within seven (7) **Days** after receipt of payment by the **City** pursuant to this Article 43.5, then the **Contractor** shall pay interest on amounts due to such **Subcontractor** or **Materialman** at the rate of interest in effect on the date such payment is made by the **Contractor** computed in accordance with Section 756-b (1)(b) of the New York General Business Law. Accrual of interest shall commence on the **Day** immediately following the expiration of the seventh **Day** following receipt of payment by the **Contractor** from the **City** and shall end on the date on which payment is made.

43.6 The **Contractor** shall include in each of its subcontracts a provision requiring each **Subcontractor** to make payment to each of its **Subcontractors** or **Materialmen** for **Work** performed under this **Contract** in the same manner and within the same time period set forth above.

ARTICLE 44. SUBSTANTIAL COMPLETION PAYMENT

44.1 The **Contractor** shall submit with the **Substantial Completion** requisition:

> 44.1.1 A final verified statement of any pending Article 27 disputes in accordance with the **PPB** Rules and this **Contract** and any and all alleged claims against the **City**, in any way connected with or arising out of this **Contract** (including those as to which details may have been furnished pursuant to Articles 11, 27, 28, and 30) setting forth with respect to each such claim the total amount thereof, the various items of labor and materials included therein, and the alleged value of each item; and if the alleged claim be one for delay, the alleged cause of each such delay, the period or periods of time, giving the dates when the

Contractor claims the performance of the **Work** or a particular part thereof was delayed, and an itemized statement and breakdown of the amount claimed for each such delay.

44.1.1(a) With respect to each such claim, the **Commissioner**, the **Comptroller** and, in the event of litigation, the **City** Corporation Counsel shall have the same right to inspect, and to make extracts or copies of, the **Contractor's** books, vouchers, records, etc., as is referred to in Articles 11, 27, 28, and 30. Nothing contained in this Article 44.1.1(a) is intended to or shall relieve the **Contractor** from the obligation of complying strictly with Articles 11, 27, 28, and 30. The **Contractor** is warned that unless such claims are completely set forth as herein required, the **Contractor** upon acceptance of the **Substantial Completion** payment pursuant to this Article 44, will have waived any such claims.

44.1.2 A **Final Approved Punch List**.

44.1.3 Where required, a request for an extension of time to achieve **Substantial Completion** or final extension of time.

44.2 The **Commissioner** shall issue a voucher calling for payment of any part or all of the balance due for **Work** performed under the **Contract**, including monies retained under Article 21, less any and all deductions authorized to be made by the **Commissioner**, under this **Contract** or by **Law**, and less twice the amount the **Commissioner** considers necessary to ensure the completion of the balance of the **Work** by the **Contractor**. Such a payment shall be considered a partial and not a final payment. No **Substantial Completion** payment shall be made under this Article 44 where the **Contractor** failed to complete the **Work** within the time fixed for such completion in the Schedule A of the General Conditions, or within the time to which completion may have been extended, until an extension or extensions of time for the completion of **Work** have been acted upon pursuant to Article 13.

44.3 No further partial payments shall be made to the **Contractor** after **Substantial Completion**, except the **Substantial Completion** payment and payment pursuant to any **Contractor's** requisition that were properly filed with the **Commissioner** prior to the date of **Substantial Completion**; however, the **Commissioner** may grant a waiver for further partial payments after the date of **Substantial Completion** to permit payments for change order **Work** and/or release of retainage and deposits pursuant to Articles 21 and 24. Such waiver shall be in writing.

44.4 The **Contractor** acknowledges that nothing contained in this Article 44 is intended to or shall in any way diminish the force and effect of Article 13.

ARTICLE 45. FINAL PAYMENT

45.1 After completion and **Final Acceptance** of the **Work**, the **Contractor** shall submit all required certificates and documents, together with a requisition for the balance claimed to be due under the **Contract**, less the amount authorized to be retained for maintenance under Article 24. Such submission shall be within 90 days of the date of the **Commissioner's** written determination of **Final Acceptance**, or within such additional time as may be granted by the **Commissioner** in writing. If the **Contractor** fails to submit all required certificates and documents within the time allowed, no payment of the balance claimed shall be made to the **Contractor** and the **Contractor** shall be deemed to have forfeited its right to payment of any balance claimed. A verified statement similar to that required in connection with applications for partial payments shall also be submitted to the **Commissioner**.

45.2 Amended Verified Statement of Claims: The **Contractor** shall also submit with the final requisition any amendments to the final verified statement of any pending dispute resolution procedures in accordance with the **PPB** Rules and this **Contract** and any and all alleged claims against the **City**, in any way connected with or arising out of this **Contract** (including those as to which details may have been furnished pursuant to Articles 11, 27, 28, and 30) that have occurred subsequent to **Substantial Completion**, setting forth with respect to each such claim the total amount thereof, the various items of labor and materials included therein, and the alleged value of each such item; and if the alleged claim be one for delay, the alleged cause of each such delay, the period or periods of time, giving the dates when the **Contractor** claims the performance of the **Work** or a particular part thereof was delayed, and an itemized statement and breakdown of the amount claimed for each such delay. With reference to each such claim, the **Commissioner**, the **Comptroller** and, in the event of litigation, the **City** Corporation Counsel shall have the same right to inspect, and to make extracts or copies of, the **Contractor's** books, vouchers, records, etc., as is referred to in Articles 11, 27, 28, and 30. Nothing contained in this Article 45.2, is intended to or shall relieve the **Contractor** from the obligation of complying strictly with Articles 11, 27, 28, and 30. The **Contractor** is warned that unless such claims are completely set forth as herein required, the **Contractor**, upon acceptance of the Final Payment pursuant to Article 46, will have waived any such claims.

45.3 Preparation of Final Voucher: Upon determining the balance due hereunder other than on account of claims, the **Engineer** will prepare and certify, for the Commissioner's approval, a voucher for final payment in that amount less any and all deductions authorized to be made by the **Commissioner** under this **Contract** or by **Law**. In the case of a lump sum **Contract**, the **Commissioner** shall certify the voucher for final payment within thirty (30) **Days** from the date of completion and acceptance of the **Work**, provided all requests for extensions of time have been acted upon.

45.3.1 All prior certificates and vouchers upon which partial payments were made, being merely estimates made to enable the **Contractor** to prosecute the **Work** more advantageously, shall be subject to correction in the final voucher, and the certification of the **Engineer** thereon and the approval of the **Commissioner** thereof, shall be conditions precedent to the right of the **Contractor** to receive any money hereunder. Such final voucher shall be binding and conclusive upon the **Contractor**.

45.3.2 Payment pursuant to such final voucher, less any deductions authorized to be made by the **Commissioner** under this **Contract** or by **Law**, shall constitute the final payment, and shall be made by the **Comptroller** within thirty (30) **Days** after the filing of such voucher in his/her office.

45.4 The **Contractor** acknowledges that nothing contained in this Article 45 is intended to or shall in any way diminish the force and effect of Article 13.

ARTICLE 46. ACCEPTANCE OF FINAL PAYMENT

46.1 The acceptance by the **Contractor**, or by anyone claiming by or through it, of the final payment, whether such payment be made pursuant to any judgment of any court, or otherwise, shall constitute and operate as a release of the **City** from any and all claims of and liability to the **Contractor** for anything heretofore done or furnished for the **Contractor** relating to or arising out of this **Contract** and the **Work** done hereunder, and for any prior act, neglect or default on the part of the **City** or any of its officials, agents or employees, excepting only a claim against the **City** for the amounts deducted or retained in accordance with the terms and provisions of this **Contract** or by **Law**, and excepting any claims, not otherwise waived, or any pending dispute resolution procedures which are contained in the

verified statement filed with the **Contractor's** substantial and final requisitions pursuant to Articles 44 and 45.

46.2 The **Contractor** is warned that the execution by it of a release, in connection with the acceptance of the final payment, containing language purporting to reserve claims other than those herein specifically excepted from the operation of this Article 46, or those for amounts deducted by the **Commissioner** from the final requisition or from the final payment as certified by the **Engineer** and approved by the **Commissioner**, shall not be effective to reserve such claims, anything stated to the **Contractor** orally or in writing by any official, agent or employee of the **City** to the contrary notwithstanding.

46.3 Should the **Contractor** refuse to accept the final payment as tendered by the **Comptroller**, it shall constitute a waiver of any right to interest thereon.

46.4 The **Contractor**, however, shall not be barred by this Article 46 from commencing an action for breach of **Contract** to the extent permitted by **Law** and by the terms of the **Contract** for any claims that are contained in the verified statement filed with the **Contractor's** substantial and final requisitions pursuant to Articles 44 and 45 or that arose after submission of the final payment requisition, provided that a detailed and verified statement of claim is served upon the contracting **Agency** and **Comptroller** not later than forty (40) **Days** after the making of such final payment by electronic funds transfer (EFT) or the mailing of such final payment. The statement shall specify the items upon which the claim will be based and any such claim shall be limited to such items.

ARTICLE 47. APPROVAL BY PUBLIC DESIGN COMMISSION

47.1 All works of art, including paintings, mural decorations, stained glass, statues, bas-reliefs, and other sculptures, monuments, fountains, arches, and other structures of a permanent character intended for ornament or commemoration, and every design of the same to be used in the performance of this **Contract**, and the design of all bridges, approaches, buildings, gates, fences, lamps, or structures to be erected, pursuant to the terms of this **Contract**, shall be submitted to the Art Commission, d/b/a the Public Design Commission of the City of New York, and shall be approved by the Public Design Commission prior to the erection or placing in position of the same. The final payment shall not become due or payable under this **Contract** unless and until the Public Design Commission shall certify that the design for the **Work** herein contracted for has been approved by the said Public Design Commission, and that the same has been executed in substantial accordance with the design so approved, pursuant to the provisions of Chapter 37, Section 854 of the **City** Charter, as amended.

CHAPTER X: CONTRACTOR'S DEFAULT

ARTICLE 48. COMMISSIONER'S RIGHT TO DECLARE CONTRACTOR IN DEFAULT

48.1 In addition to those instances specifically referred to in other Articles herein, the **Commissioner** shall have the right to declare the **Contractor** in default of this **Contract** if:

48.1.1 The **Contractor** fails to commence **Work** when notified to do so by the **Commissioner**; or if

48.1.2 The **Contractor** shall abandon the **Work**; or if

48.1.3 The **Contractor** shall refuse to proceed with the **Work** when and as directed by the **Commissioner**; or if

48.1.4 The **Contractor** shall, without just cause, reduce its working force to a number which, if maintained, would be insufficient, in the opinion of the **Commissioner**, to complete the **Work** in accordance with the progress schedule; or if

48.1.5 The **Contractor** shall fail or refuse to increase sufficiently such working force when ordered to do so by the **Commissioner**; or if

48.1.6 The **Contractor** shall sublet, assign, transfer, convert or otherwise dispose of this **Contract** other than as herein specified; or sell or assign a majority interest in the **Contractor**; or if

48.1.7 The **Contractor** fails to secure and maintain all required insurance; or if

48.1.8 A receiver or receivers are appointed to take charge of the **Contractor's** property or affairs; or if

48.1.9 The **Commissioner** shall be of the opinion that the **Contractor** is or has been unnecessarily or unreasonably or willfully delaying the performance and completion of the **Work**, or the award of necessary subcontracts, or the placing of necessary material and equipment orders; or if

48.1.10 The **Commissioner** shall be of the opinion that the **Contractor** is or has been willfully or in bad faith violating any of the provisions of this **Contract**; or if

48.1.11 The **Commissioner** shall be of the opinion that the **Work** cannot be completed within the time herein provided therefor or within the time to which such completion may have been extended; provided, however, that the impossibility of timely completion is, in the **Commissioner's** opinion, attributable to conditions within the **Contractor's** control; or if

48.1.12 The **Work** is not completed within the time herein provided therefor or within the time to which the **Contractor** may be entitled to have such completion extended; or if

48.1.13 Any statement or representation of the **Contractor** in the **Contract** or in any document submitted by the **Contractor** with respect to the **Work**, the **Project**, or the **Contract** (or for purposes of securing the **Contract**) was untrue or incorrect when made; or if

48.1.14 The **Contractor** or any of its officers, directors, partners, five (5%) percent shareholders, principals, or other persons substantially involved in its activities, commits any of the acts or omissions specified as the grounds for debarment in the **PPB** Rules.

48.2 Before the **Commissioner** shall exercise his/her right to declare the **Contractor** in default, the **Commissioner** shall give the **Contractor** an opportunity to be heard, upon not less than two (2) **Days'** notice.

ARTICLE 49. EXERCISE OF THE RIGHT TO DECLARE DEFAULT

49.1 The right to declare the **Contractor** in default for any of the grounds specified or referred to in Article 48 shall be exercised by sending the **Contractor** a notice, signed by the **Commissioner**, setting forth the ground or grounds upon which such default is declared (hereinafter referred to as a "Notice of Default").

49.2 The **Commissioner's** determination that the **Contractor** is in default shall be conclusive, final, and binding on the parties and such a finding shall preclude the **Contractor** from commencing a plenary action for any damages relating to the **Contract**. If the **Contractor** protests the determination of the **Commissioner**, the **Contractor** may commence an action in a court of competent jurisdiction of the State of New York under Article 78 of the New York Civil Practice Law and Rules.

ARTICLE 50. QUITTING THE SITE

50.1 Upon receipt of such notice the **Contractor** shall immediately discontinue all further operations under this **Contract** and shall immediately quit the **Site**, leaving untouched all plant, materials, equipment, tools, and supplies then on the **Site**.

ARTICLE 51. COMPLETION OF THE WORK

51.1 The **Commissioner**, after declaring the **Contractor** in default, may then have the **Work** completed by such means and in such manner, by contract with or without public letting, or otherwise, as he/she may deem advisable, utilizing for such purpose such of the **Contractor's** plant, materials, equipment, tools, and supplies remaining on the **Site**, and also such **Subcontractors**, as he/she may deem advisable.

51.2 After such completion, the **Commissioner** shall make a certificate stating the expense incurred in such completion, which shall include the cost of re-letting and also the total amount of liquidated damages (at the rate provided for in the **Contract**) from the date when the **Work** should have been completed by the **Contractor** in accordance with the terms hereof to the date of actual completion of the **Work**. Such certificate shall be binding and conclusive upon the **Contractor**, its sureties, and any person claiming under the **Contractor**, as to the amount thereof.

51.3 The expense of such completion, including any and all related and incidental costs, as so certified by the **Commissioner**, and any liquidated damages assessed against the **Contractor**, shall be charged against and deducted out of monies which are earned by the **Contractor** prior to the date of default. Should the expense of such completion, as certified by the **Commissioner**, exceed the total sum which would have been payable under the **Contract** if it had been completed by the **Contractor**, any excess shall be paid by the **Contractor**.

ARTICLE 52. PARTIAL DEFAULT

52.1 In case the **Commissioner** shall declare the **Contractor** in default as to a part of the **Work** only, the **Contractor** shall discontinue such part, shall continue performing the remainder of the **Work** in strict conformity with the terms of this **Contract**, and shall in no way hinder or interfere with any **Other Contractor(s)** or persons whom the **Commissioner** may engage to complete the **Work** as to which the **Contractor** was declared in default.

52.2 The provisions of this Chapter relating to declaring the **Contractor** in default as to the entire **Work** shall be equally applicable to a declaration of partial default, except that the **Commissioner** shall be entitled to utilize for completion of the part of the **Work** as to which the **Contractor** was declared in default only such plant, materials, equipment, tools, and supplies as had been previously used by the **Contractor** on such part.

ARTICLE 53. PERFORMANCE OF UNCOMPLETED WORK

53.1 In completing the whole or any part of the **Work** under the provisions of this Chapter X, the **Commissioner** shall have the power to depart from or change or vary the terms and provisions of this **Contract**, provided, however, that such departure, change or variation is made for the purpose of reducing the time or expense of such completion. Such departure, change or variation, even to the extent of accepting a lesser or different performance, shall not affect the conclusiveness of the **Commissioner's** certificate of the cost of completion referred to in Article 51, nor shall it constitute a defense to an action to recover the amount by which such certificate exceeds the amount which would have been payable to the **Contractor** hereunder but for its default.

ARTICLE 54. OTHER REMEDIES

54.1 In addition to the right to declare the **Contractor** in default pursuant to this Chapter X, the **Commissioner** shall have the absolute right, in his/her sole discretion and without a hearing, to complete or cause to be completed in the same manner as described in Articles 51 and 53, any or all unsatisfactory or uncompleted punch list **Work** that remains after the completion date specified in the **Final Approved Punch List**. A written notice of the exercise of this right shall be sent to the **Contractor** who shall immediately quit the **Site** in accordance with the provisions of Article 50.

54.2 The expense of completion permitted under Article 54.1, including any and all related and incidental costs, as so certified by the **Commissioner**, shall be charged against and deducted out of monies which have been earned by the **Contractor** prior to the date of the exercise of the right set forth in Article 54.1; the balance of such monies, if any, subject to the other provisions of this **Contract**, to be paid to the **Contractor** without interest after such completion. Should the expense of such completion, as certified by the **Commissioner**, exceed the total sum which would have been payable under the **Contract** if it had been completed by the **Contractor**, any excess shall be paid by the **Contractor**.

54.3 The previous provisions of this Chapter X shall be in addition to any and all other remedies available under **Law** or in equity.

54.4 The exercise by the **City** of any remedy set forth herein shall not be deemed a waiver by the **City** of any other legal or equitable remedy contained in this **Contract** or provided under **Law**.

CHAPTER XI: MISCELLANEOUS PROVISIONS

ARTICLE 55. CONTRACTOR'S WARRANTIES

55.1 In consideration of, and to induce, the award of this **Contract** to the **Contractor**, the **Contractor** represents and warrants:

55.1.1 That it is financially solvent, sufficiently experienced and competent to perform the **Work**; and

55.1.2 That the facts stated in its bid and the information given by it pursuant to the Information for Bidders is true and correct in all respects; and

55.1.3 That it has read and complied with all requirements set forth in the **Contract**.

ARTICLE 56. CLAIMS AND ACTIONS THEREON

56.1 Any claim, that is not subject to dispute resolution under the **PPB** Rules or this **Contract**, against the **City** for damages for breach of **Contract** shall not be made or asserted in any action, unless the **Contractor** shall have strictly complied with all requirements relating to the giving of notice and of information with respect to such claims, as herein before provided.

56.2 Nor shall any action be instituted or maintained on any such claims unless such action is commenced within six (6) months after **Substantial Completion**; except that:

56.2.1 Any claims arising out of events occurring after **Substantial Completion** and before **Final Acceptance** of the **Work** shall be asserted within six (6) months of **Final Acceptance** of the **Work**;

56.2.2 If the **Commissioner** exercises his/her right to complete or cause to complete any or all unsatisfactory or uncompleted punch list **Work** that remains after the completion date specified in the **Final Approved Punch List** pursuant to Article 54, any such action shall be commenced within six (6) months from the date the **Commissioner** notifies the **Contractor** in writing that he/she has exercised such right. Any claims for monies deducted, retained or withheld under the provisions of this **Contract** shall be asserted within six (6) months after the date when such monies otherwise become due and payable hereunder; and

56.2.3 If the **Commissioner** exercises his/her right to terminate the **Contract** pursuant to Article 64, any such action shall be commenced within six (6) months of the date the **Commissioner** exercises said right.

ARTICLE 57. INFRINGEMENT

57.1 The **Contractor** shall be solely responsible for and shall defend, indemnify, and hold the **City** harmless from any and all claims (even if the allegations of the lawsuit are without merit) and judgments for damages and from costs and expenses to which the **City** may be subject to or which it may suffer or incur allegedly arising out of or in connection with any infringement by the **Contractor** of any copyright, trade secrets, trademark or patent rights or any other property or personal right of any third party by the **Contractor** and/or its **Subcontractors** in the performance or completion of the **Work**. Insofar as the facts or **Law** relating to any claim would preclude the **City** from being completely indemnified by the **Contractor**, the **City** shall be partially indemnified by the **Contractor** to the fullest extent permitted by **Law**.

ARTICLE 58. NO CLAIM AGAINST OFFICIALS, AGENTS OR EMPLOYEES

58.1 No claim whatsoever shall be made by the **Contractor** against any official, agent or employee of the **City** for, or on account of, anything done or omitted to be done in connection with this **Contract**.

ARTICLE 59. SERVICE OF NOTICES

59.1 The **Contractor** hereby designates the business address, fax number, and email address specified in its bid, as the place where all notices, directions or other communications to the **Contractor** may be delivered, or to which they may be mailed. Any notice, direction, or communication from either party to the other shall be in writing and shall be deemed to have been given when (i) delivered personally; (ii) sent by certified mail, return receipt requested; (iii) delivered by overnight or same day courier service in a properly addressed envelope with confirmation; or (iv) sent by fax or email and, unless receipt of the fax or e-mail is acknowledged by the recipient by fax or e-mail, deposited in a post office box regularly maintained by the United States Postal Service in a properly addressed, postage pre-paid envelope.

59.2 **Contractor's** notice address, email address, or fax number may be changed at any time by an instrument in writing, executed and acknowledged by the **Contractor**, and delivered to the **Commissioner**.

59.3 Nothing herein contained shall, however, be deemed to preclude or render inoperative the service of any notice, direction or other communication upon the **Contractor** personally, or, if the **Contractor** is a corporation, upon any officer thereof.

ARTICLE 60. UNLAWFUL PROVISIONS DEEMED STRICKEN FROM CONTRACT

60.1 If this **Contract** contains any unlawful provision not an essential part of the **Contract** and which shall not appear to have been a controlling or material inducement to the making thereof, the same shall be deemed of no effect and shall, upon notice by either party, be deemed stricken from the **Contract** without affecting the binding force of the remainder.

ARTICLE 61. ALL LEGAL PROVISIONS DEEMED INCLUDED

61.1 It is the intent and understanding of the parties to this **Contract** that each and every provision of **Law** required to be inserted in this **Contract** shall be and is inserted herein. Furthermore, it is hereby stipulated that every such provision is to be deemed to be inserted herein, and if, through mistake or otherwise, any such provision is not inserted, or is not inserted in correct form, then this **Contract** shall forthwith upon the application of either party be amended by such insertion so as to comply strictly with the **Law** and without prejudice to the rights of either party hereunder.

ARTICLE 62. TAX EXEMPTION

62.1 The **City** is exempt from payment of Federal, State, and local taxes, including sales and compensating use taxes of the State of New York and its cities and counties on all tangible personal property sold to the **City** pursuant to the provisions of this **Contract**. These taxes are not to be included in bids. However, this exemption does not apply to tools, machinery, equipment or other property leased by or to the **Contractor**, **Subcontractor** or **Materialman** or to tangible personal property which, even

though it is consumed, is not incorporated into the completed **Work** (consumable supplies) and tangible personal property that the **Contractor** is required to remove from the **Site** during or upon completion of the **Work**. The **Contractor** and its **Subcontractors** and **Materialmen** shall be responsible for and pay any and all applicable taxes, including sales and compensating use taxes, on such leased tools, machinery, equipment or other property and upon all such consumable supplies and tangible personal property that the **Contractor** is required to remove from the **Site** during or upon completion of the **Work**.

62.2 The **Contractor** agrees to sell and the **City** agrees to purchase all tangible personal property, other than consumable supplies and other tangible personal property that the **Contractor** is required to remove from the **Site** during or upon completion of the **Work**, that is required, necessary or proper for or incidental to the construction of the **Project** covered by this **Contract**. The sum paid under this **Contract** for such tangible personal property shall be in full payment and consideration for the sale of such tangible personal property.

62.2.1 The **Contractor** agrees to construct the **Project** and to perform all **Work**, labor and services rendered, necessary, proper or incidental thereto for the sum shown in the bid for the performance of such **Work**, labor, and services, and the sum so paid pursuant to this **Contract** for such **Work**, labor, and services, shall be in full consideration for the performance by the **Contractor** of all its duties and obligations under this **Contract** in connection with said **Work,** labor, and services.

62.3 20 NYCRR Section 541.3(d) provides that a **Contractor**'s purchases of tangible personal property that is either incorporated into real property owned by a governmental entity or purchased for and sold to a governmental entity are exempt from sales and use tax. The **City** shall not pay sales tax for any such tangible personal property that it purchases from the **Contractor** pursuant to the **Contract.** With respect to such tangible personal property, the **Contractor**, at the request of the **City**, shall furnish to the **City** such bills of sale and other instruments as may be required by the **City**, properly executed, acknowledged and delivered assuring to the **City** title to such tangible personal property, free of liens and/or encumbrances, and the **Contractor** shall mark or otherwise identify all such tangible personal property as the property of the **City**.

62.4 Title to all tangible personal property to be sold by the **Contractor** to the **City** pursuant to the provisions of the **Contract** shall immediately vest in and become the sole property of the **City** upon delivery of such tangible personal property to the **Site**. Notwithstanding such transfer of title, the **Contractor** shall have the full and continuing responsibility to install such tangible personal property in accordance with the provisions of this **Contract**, protect it, maintain it in a proper condition and forthwith repair, replace and make good any damage thereto, theft or disappearance thereof, and furnish additional tangible personal property in place of any that may be lost, stolen or rendered unusable, without cost to the **City**, until such time as the **Work** covered by the **Contract** is fully accepted by the **City**. Such transfer of title shall in no way affect any of the **Contractor's** obligations hereunder. In the event that, after title has passed to the **City**, any of the tangible personal property is rejected as being defective or otherwise unsatisfactory, title to all such tangible personal property shall be deemed to have been transferred back to the **Contractor**.

62.5 The purchase by **Subcontractors** or **Materialmen** of tangible personal property to be sold hereunder shall be a purchase or procurement for resale to the **Contractor** (either directly or through other **Subcontractors**) and therefore not subject to the aforesaid sales and compensating use taxes, provided that the subcontracts and purchase agreements provide for the resale of such tangible personal property and that such subcontracts and purchase agreements are in a form similar to this **Contract** with respect to the separation of the sale of consumable supplies and tangible personal property that the

Contractor is required to remove from the **Site** during or upon completion of the **Work** from the **Work** and labor, services, and any other matters to be provided, and provided further that the subcontracts and purchase agreements provide separate prices for tangible personal property and all other services and matters. Such separation shall actually be followed in practice, including the separation of payments for tangible personal property from the payments for other **Work** and labor and other things to be provided.

62.6 The **Contractor** and its **Subcontractors** and **Materialmen** shall furnish a **Contractor** Exempt Purchase Certificate to all persons, firms or corporations from which they purchase tangible personal property for the performance of the **Work** covered by this **Contract**.

62.7 In the event any of the provisions of this Article 62 shall be deemed to be in conflict with any other provisions of this **Contract** or create any ambiguity, then the provisions of this Article 62 shall control.

ARTICLE 63. INVESTIGATION(S) CLAUSE

63.1 The parties to this **Contract** agree to cooperate fully and faithfully with any investigation, audit or inquiry conducted by a United States, a State of New York (State) or a **City** governmental agency or authority that is empowered directly or by designation to compel the attendance of witnesses and to examine witnesses under oath, or conducted by the Inspector General of a governmental agency that is a party in interest to the transaction, submitted bid, submitted proposal, contract, lease, permit or license that is the subject of the investigation, audit or inquiry.

63.2 If any person who has been advised that his/her statement, and any information from such statement, will not be used against him/her in any subsequent criminal proceeding refuses to testify before a grand jury or other governmental agency or authority empowered directly or by designation to compel the attendance of witnesses and to examine witnesses under oath concerning the award of or performance under any transaction, agreement, lease, permit, contract, or license entered into with the **City**, the State, or any political subdivision or public authority thereof, or the Port Authority of New York and New Jersey, or any local development corporation within the **City**, or any public benefit corporation organized under the **Laws** of the State of New York, or;

63.3 If any person refuses to testify for a reason other than the assertion of his/her privilege against self incrimination in an investigation, audit or inquiry conducted by a **City** or State governmental agency or authority empowered directly or by designation to compel the attendance of witnesses and to take testimony under oath, or by the Inspector General of the governmental agency that is a party in interest in, and is seeking testimony concerning the award of, or performance under any transaction, agreement, lease, permit, contract, or license entered into with the **City**, the State, or any political subdivision thereof or any local development corporation within the **City**, then;

63.4 The **Commissioner** whose **Agency** is a party in interest to the transaction, submitted bid, submitted proposal, contract, lease, permit, or license shall convene a hearing, upon not less than five (5) **Days**' written notice to the parties involved to determine if any penalties should attach for the failure of a person to testify.

63.5 If any non-governmental party to the hearing requests an adjournment, the **Commissioner** who convened the hearing may, upon granting the adjournment, suspend any contract, lease, permit, or license, pending the final determination pursuant to Article 63.7 without the **City** incurring any penalty or damages for delay or otherwise.

63.6 The penalties which may attach after a final determination by the **Commissioner** may include but shall not exceed:

63.6.1 The disqualification for a period not to exceed five (5) years from the date of an adverse determination for any person, or any entity of which such person was a member at the time the testimony was sought, from submitting bids for, or transacting business with, or entering into or obtaining any contract, lease, permit or license with or from the **City**; and/or

63.6.2 The cancellation or termination of any and all such existing **City** contracts, leases, permits or licenses that the refusal to testify concerns and that have not been assigned as permitted under this **Contract**, nor the proceeds of which pledged, to an unaffiliated and unrelated institutional lender for fair value prior to the issuance of the notice scheduling the hearing, without the **City** incurring any penalty or damages on account of such cancellation or termination; monies lawfully due for goods delivered, work done, rentals, or fees accrued prior to the cancellation or termination shall be paid by the **City**.

63.7 The **Commissioner** shall consider and address in reaching his/her determination and in assessing an appropriate penalty the factors in Articles 63.7.1 and 63.7.2. The **Commissioner** may also consider, if relevant and appropriate, the criteria established in Articles 63.7.3 and 63.7.4, in addition to any other information which may be relevant and appropriate:

63.7.1 The party's good faith endeavors or lack thereof to cooperate fully and faithfully with any governmental investigation or audit, including but not limited to the discipline, discharge, or disassociation of any person failing to testify, the production of accurate and complete books and records, and the forthcoming testimony of all other members, agents, assignees or fiduciaries whose testimony is sought.

63.7.2 The relationship of the person who refused to testify to any entity that is a party to the hearing, including but not limited to, whether the person whose testimony is sought has an ownership interest in the entity and/or the degree of authority and responsibility the person has within the entity.

63.7.3 The nexus of the testimony sought to the subject entity and its contracts, leases, permits or licenses with the **City**.

63.7.4 The effect a penalty may have on an unaffiliated and unrelated party or entity that has a significant interest in an entity subject to penalties under Article 63.6, provided that the party or entity has given actual notice to the **Commissioner** upon the acquisition of the interest, or at the hearing called for in Article 63.4, gives notice and proves that such interest was previously acquired. Under either circumstance the party or entity shall present evidence at the hearing demonstrating the potential adverse impact a penalty will have on such person or entity.

63.8 Definitions:

63.8.1 The term "license" or "permit" as used in this Article 63 shall be defined as a license, permit, franchise or concession not granted as a matter of right.

63.8.2 The term "person" as used in this Article 63 shall be defined as any natural person doing business alone or associated with another person or entity as a partner, director, officer, principal or employee.

63.8.3 The term "entity" as used in this Article 63 shall be defined as any firm, partnership, corporation, association, joint venture, or person that receives monies, benefits, licenses, leases, or permits from or through the **City** or otherwise transacts business with the **City**.

63.8.4 The term "member" as used in this Article 63 shall be defined as any person associated with another person or entity as a partner, director, officer, principal or employee.

63.9 In addition to and notwithstanding any other provision of this **Contract**, the **Commissioner** may in his/her sole discretion terminate this **Contract** upon not less than three (3) **Days'** written notice in the event the **Contractor** fails to promptly report in writing to the **Commissioner** of the Department of Investigations ("DOI") of the **City** any solicitation of money, goods, requests for future employment or other benefit or thing of value, by or on behalf of any employee of the **City** or other person, firm, corporation or entity for any purpose which may be related to the procurement or obtaining of this **Contract** by the **Contractor**, or affecting the performance of this **Contract**.

ARTICLE 64. TERMINATION BY THE CITY

64.1 In addition to termination pursuant to any other article of this **Contract**, the **Commissioner** may, at any time, terminate this **Contract** by written notice to the **Contractor**. In the event of termination, the **Contractor** shall, upon receipt of such notice, unless otherwise directed by the **Commissioner**:

64.1.1 Stop **Work** on the date specified in the notice;

64.1.2 Take such action as may be necessary for the protection and preservation of the **City's** materials and property;

64.1.3 Cancel all cancelable orders for material and equipment;

64.1.4 Assign to the **City** and deliver to the **Site** or another location designated by the **Commissioner**, any non-cancelable orders for material and equipment that is not capable of use except in the performance of this **Contract** and has been specifically fabricated for the sole purpose of this **Contract** and not incorporated in the **Work**;

64.1.5 Take no action which will increase the amounts payable by the **City** under this **Contract**.

64.2 In the event of termination by the **City** pursuant to this Article 64, payment to the **Contractor** shall be in accordance with Articles 64.2.1, 64.2.2 or 64.2.3, to the extent that each respective article applies.

64.2.1 Lump Sum Contracts or Items: On all lump sum **Contracts**, or on lump sum items in a **Contract**, the **City** will pay the **Contractor** the sum of the amounts described in Articles 64.2.1(a) and 64.2.1(b), less all payments previously made pursuant to this **Contract**. On lump sum **Contracts** only, the **City** will also pay the **Contractor** an additional sum as provided in Article 64.2.1(c).

64.2.1(a) For **Work** completed prior to the notice of termination, the **Contractor** shall be paid a pro rata portion of the lump sum bid amount, plus approved change orders, based upon the percent completion of the **Work**, as determined by the

Commissioner. For the purpose of determining the pro rata portion of the lump sum bid amount to which the **Contractor** is entitled, the bid breakdown submitted in accordance with Article 41 shall be considered, but shall not be dispositive. The **Commissioner's** determination hereunder shall be final, binding, and conclusive.

64.2.1(b) For non-cancelable material and equipment that is not capable of use except in the performance of this **Contract** and has been specifically fabricated for the sole purpose of this **Contract**, but not yet incorporated in the **Work**, the **Contractor** shall be paid the lesser of the following, less salvage value:

64.2.1(b)(i) The Direct Cost, as defined in Article 64.2.4; or

64.2.1(b)(ii) The fair and reasonable value, if less than Direct Cost, of such material and equipment, plus necessary and reasonable delivery costs.

64.2.1(b)(iii) In addition, the **Contractor** shall be paid five (5%) percent of the amount described in Article 64.2.1(b)(i) or Article 64.2.1(b)(ii), whichever applies.

64.2.1(c) Except as otherwise provided in Article 64.2.1(d), on all lump sum **Contracts**, the **Contractor** shall be paid the percentage indicated below applied to the difference between the total lump sum bid amount and the total of all payments made prior to the notice of termination plus all payments allowed pursuant to Articles 64.2.1(a) and 64.2.1(b):

64.2.1(c)(i) Five (5%) percent of the first five million ($5,000,000) dollars; and

64.2.1(c)(ii) Three (3%) percent of any amount between five million ($5,000,000) dollars and fifteen million ($15,000,000) dollars; plus

64.2.1(c)(iii) One (1%) percent of any amount over fifteen million ($15,000,000) dollars.

64.2.1(d) In the event the **City** terminates a lump sum **Contract** pursuant to this Article 64 within ninety (90) **Days** after registration of the **Contract** with the **Comptroller**, the **Contractor** shall be paid one (1%) percent of the difference between the lump sum bid amount and the total of all payments made pursuant to this Article 64.2.

64.2.2 Unit Price Contracts or Items: On all unit price **Contracts**, or on unit price items in a **Contract**, the **City** will pay the **Contractor** the sum of the amounts described in Articles 64.2.2(a) and 64.2.2(b), less all payments previously made pursuant to this **Contract**:

64.2.2(a) For all completed units, the unit price stated in the **Contract**, and

64.2.2(b) For units that have been ordered but are only partially completed, the **Contractor** will be paid:

64.2.2(b)(i) A pro rata portion of the unit price stated in the **Contract** based upon the percent completion of the unit and

64.2.2(b)(ii) For non-cancelable material and equipment, payment will be made pursuant to Article 64.2.1(b).

64.2.3 Time and Materials Contracts or Items Based on Time and Material Records: On all **Contracts** or items in a **Contract** where payment for the **Work** is based on time and material records, the **Contractor** shall be paid in accordance with Article 26, less all payments previously made pursuant to this **Contract**.

64.2.4 Direct Costs: Direct Costs as used in this Article 64.2 shall mean:

64.2.4(a) The actual purchase price of material and equipment, plus necessary and reasonable delivery costs,

64.2.4(b) The actual cost of labor involved in construction and installation at the **Site**, and

64.2.4(c) The actual cost of necessary bonds and insurance purchased pursuant to requirements of this **Contract** less any amounts that have been or should be refunded by the **Contractor's** sureties or insurance carriers.

64.2.4(d) Direct Costs shall not include overhead.

64.3 In no event shall any payments under this Article 64 exceed the **Contract** price for such items.

64.4 All payments pursuant to Article 64 shall be in the nature of liquidated damages and shall be accepted by the **Contractor** in full satisfaction of all claims against the **City**.

64.5 The **City** may deduct or set off against any sums due and payable pursuant to this Article 64, any deductions authorized by this **Contract** or by **Law** (including but not limited to liquidated damages) and any claims it may have against the **Contractor**. The **City's** exercise of the right to terminate the **Contract** pursuant to this Article 64 shall not impair or otherwise effect the **City's** right to assert any claims it may have against the **Contractor** in a plenary action.

64.6 Where the **Work** covered by the **Contract** has been substantially completed, as determined in writing by the **Commissioner**, termination of the **Work** shall be handled as an omission of **Work** pursuant to Articles 29 and 33, in which case a change order will be issued to reflect an appropriate reduction in the **Contract** sum, or if the amount is determined after final payment, such amount shall be paid by the **Contractor**.

ARTICLE 65. CHOICE OF LAW, CONSENT TO JURISDICTION AND VENUE

65.1 This **Contract** shall be deemed to be executed in the **City** regardless of the domicile of the **Contractor**, and shall be governed by and construed in accordance with the **Laws** of the State of New York and the **Laws** of the United States, where applicable.

65.2 The parties agree that any and all claims asserted against the **City** arising under this **Contract** or related thereto shall be heard and determined in the courts of the State of New York ("New York State Courts") located in the **City** and County of New York. To effect this **Contract** and intent, the **Contractor** agrees:

65.2.1 If the **City** initiates any action against the **Contractor** in Federal court or in a New York State Court, service of process may be made on the **Contractor** either in person, wherever such **Contractor** may be found, or by registered mail addressed to the **Contractor** at its address as set forth in this **Contract**, or to such other address as the **Contractor** may provide to the **City** in writing; and

65.2.2 With respect to any action between the **City** and the **Contractor** in a New York State Court, the **Contractor** hereby expressly waives and relinquishes any rights it might otherwise have:

65.2.2(a) To move to dismiss on grounds of forum non conveniens;

65.2.2(b) To remove to Federal Court; and

65.2.2(c) To move for a change of venue to a New York State Court outside New York County.

65.2.3 With respect to any action brought by the **City** against the **Contractor** in a Federal Court located in the **City**, the **Contractor** expressly waives and relinquishes any right it might otherwise have to move to transfer the action to a Federal Court outside the **City**.

65.2.4 If the **Contractor** commences any action against the **City** in a court located other than in the **City** and County of New York, upon request of the **City**, the **Contractor** shall either consent to a transfer of the action to a New York State Court of competent jurisdiction located in the **City** and County of New York or, if the Court where the action is initially brought will not or cannot transfer the action, the **Contractor** shall consent to dismiss such action without prejudice and may thereafter reinstate the action in a New York State Court of competent jurisdiction in New York County.

65.3 If any provision(s) of this Article 65 is held unenforceable for any reason, each and all other provision(s) shall nevertheless remain in full force and effect.

ARTICLE 66. PARTICIPATION IN AN INTERNATIONAL BOYCOTT

66.1 The **Contractor** agrees that neither the **Contractor** nor any substantially owned affiliated company is participating or shall participate in an international boycott in violation of the provisions of the Federal Export Administration Act of 1979, as amended, or the regulations of the United States Department of Commerce (Commerce Department) promulgated thereunder.

66.2 Upon the final determination by the Commerce Department or any other agency of the United States as to, or conviction of the **Contractor** or a substantially-owned affiliated company thereof for participation in an international boycott in violation of the provisions of the Export Administration Act of 1979, as amended, or the regulations promulgated thereunder, the **Comptroller** may, at his/her option, render forfeit and void this **Contract**.

66.3 The **Contractor** shall comply in all respects, with the provisions of Section 6-114 of the Administrative Code and the rules and regulations issued by the **Comptroller** thereunder.

ARTICLE 67. LOCALLY BASED ENTERPRISE PROGRAM

67.1 This **Contract** is subject to the requirements of Section 6-108.1 of the Administrative Code and regulations promulgated thereunder. No construction contract shall be awarded unless and until these requirements have been complied with in their entirety; however, compliance with this Article 67 is not required if the Agency sets Subcontractor Participation Goals for Minority- and Women-Owned Business Enterprises (M/WBEs).

67.2 Unless specifically waived by the **Commissioner** with the approval of the Division of Economic and Financial Opportunity of the **City** Department of Business Services, if any portion of the **Contract** is subcontracted, not less than ten (10%) percent of the total dollar amount of the **Contract** shall be awarded to locally based enterprises (LBEs); except that where less than ten (10%) percent of the total dollar amount of the **Contract** is subcontracted, such lesser percentage shall be so awarded.

67.3 The **Contractor** shall not require performance and payment bonds from LBE **Subcontractors**.

67.4 If the **Contractor** has indicated prior to award that no **Work** will be subcontracted, no **Work** shall be subcontracted without the prior approval of the **Commissioner**, which shall be granted only if the **Contractor** makes a good faith effort beginning at least six (6) weeks before the **Work** is to be performed to obtain LBE **Subcontractors** to perform the **Work**.

67.5 If the **Contractor** has not identified sufficient LBE **Subcontractors** prior to award, it shall sign a letter of compliance stating that it complies with Section 6-108.1 of the Administrative Code, recognizes that achieving the LBE requirement is a condition of its **Contract**, and shall submit documentation demonstrating its good faith efforts to obtain LBEs. After award, the **Contractor** shall begin to solicit LBE's to perform subcontracted **Work** at least six (6) weeks before the date such **Work** is to be performed and shall demonstrate that a good faith effort has been made to obtain LBEs on each subcontract until it meets the required percentage.

67.6 Failure of the **Contractor** to comply with the requirements of Section 6-108.1 of the Administrative Code and the regulations promulgated thereunder shall constitute a material breach of this **Contract**. Remedy for such breach may include the imposition of any or all of the following sanctions:

67.6.1 Reducing the **Contractor's** compensation by an amount equal to the dollar value of the percentage of the LBE subcontracting requirement not complied with;

67.6.2 Declaring the **Contractor** in default;

67.6.3 If the **Contractor** is an LBE, de-certifying and declaring the **Contractor** ineligible to participate in the LBE program for a period of up to three (3) years.

ARTICLE 68. ANTITRUST

68.1 The **Contractor** hereby assigns, sells, and transfers to the **City** all right, title, and interest in and to any claims and causes of action arising under the antitrust **Laws** of New York State or of the United States relating to the particular goods or services purchased or procured by the **City** under this **Contract**.

ARTICLE 69. MacBRIDE PRINCIPLES PROVISIONS

69.1 Notice To All Prospective **Contractors**:

69.1.1 Local Law No. 34 of 1991 became effective on September 10, 1991 and added Section 6-115.1 of the Administrative Code. The local **Law** provides for certain restrictions on **City Contracts** to express the opposition of the people of the **City** to employment discrimination practices in Northern Ireland to promote freedom of work-place opportunity.

69.1.2 Pursuant to Section 6-115.1, prospective **Contractors** for **Contracts** to provide goods or services involving an expenditure of an amount greater than ten thousand ($10,000.) dollars, or for construction involving an amount greater than fifteen thousand ($15,000.) dollars, are asked to sign a rider in which they covenant and represent, as a material condition of their **Contract**, that any business operations in Northern Ireland conducted by the **Contractor** and any individual or legal entity in which the **Contractor** holds a ten (10%) percent or greater ownership interest in the **Contractor** will be conducted in accordance with the MacBride Principles of nondiscrimination in employment.

69.1.3 Prospective **Contractors** are not required to agree to these conditions. However, in the case of **Contracts** let by competitive sealed bidding, whenever the lowest responsible bidder has not agreed to stipulate to the conditions set forth in this notice and another bidder who has agreed to stipulate to such conditions has submitted a bid within five (5%) percent of the lowest responsible bid for a **Contract** to supply goods, services or contraction of comparable quality, the **Agency** shall refer such bids to the Mayor, the Speaker or other officials, as appropriate, who may determine, in accordance with applicable **Law**, that it is in the best interest of the **City** that the **Contract** be awarded to other than the lowest responsible pursuant to Section 313(b)(2) of the **City** Charter.

69.1.4 In the case of **Contracts** let by other than competitive sealed bidding, if a prospective **Contractor** does not agree to these conditions, no **Agency**, elected official or the **City** Council shall award the **Contract** to that bidder unless the **Agency** seeking to use the goods, services or construction certifies in writing that the **Contract** is necessary for the **Agency** to perform its functions and there is no other responsible **Contractor** who will supply goods, services or construction of comparable quality at a comparable price.

69.2 In accordance with Section 6-115.1 of the Administrative Code, the **Contractor** stipulates that such **Contractor** and any individual or legal entity in which the **Contractor** holds a ten (10%) percent or greater ownership interest in the **Contractor** either:

69.2.1 Have no business operations in Northern Ireland, or

69.2.2 Shall take lawful steps in good faith to conduct any business operations they have in Northern Ireland in accordance with the MacBride Principles, and shall permit independent monitoring of their compliance with such principles.

69.3 For purposes of this Article, the following terms shall have the following meanings:

69.3.1 "MacBride Principles" shall mean those principles relating to nondiscrimination in employment and freedom of work-place opportunity which require employers doing business in Northern Ireland to:

69.3.1(a) increase the representation of individuals from under-represented religious groups in the workforce, including managerial, supervisory, administrative, clerical and technical jobs;

69.3.1(b) take steps to promote adequate security for the protection of employees from under-represented religious groups both at the work-place and while traveling to and from **Work**;

69.3.1(c) ban provocative religious or political emblems from the workplace;

69.3.1(d) publicly advertise all job openings and make special recruitment efforts to attract applicants from under-represented religious groups;

69.3.1(e) establish layoff, recall, and termination procedures which do not in practice favor a particular religious group;

69.3.1(f) abolish all job reservations, apprenticeship restrictions and different employment criteria which discriminate on the basis of religion;

69.3.1(g) develop training programs that will prepare substantial numbers of current employees from under-represented religious groups for skilled jobs, including the expansion of existing programs and the creation of new programs to train, upgrade, and improve the skills of workers from under-represented religious groups;

69.3.1(h) establish procedures to asses, identify, and actively recruit employees from under-represented religious groups with potential for further advancement; and

69.3.1(i) appoint a senior management staff member to oversee affirmative action efforts and develop a timetable to ensure their full implementation.

69.4 The **Contractor** agrees that the covenants and representations in Article 69.2 are material conditions to this **Contract**. In the event the **Agency** receives information that the **Contractor** who made the stipulation required by this Article 69 is in violation thereof, the **Agency** shall review such information and give the **Contractor** an opportunity to respond. If the **Agency** finds that a violation has occurred, the **Agency** shall have the right to declare the **Contractor** in default in default and/or terminate this **Contract** for cause and procure supplies, services or **Work** from another source in the manner the **Agency** deems proper. In the event of such termination, the **Contractor** shall pay to the **Agency**, or the **Agency** in its sole discretion may withhold from any amounts otherwise payable to the **Contractor**, the difference between the **Contract** price for the uncompleted portion of this **Contract** and the cost to the **Agency** of completing performance of this **Contract** either itself or by engaging another **Contractor** or **Contractors**. In the case of a requirement **Contract**, the **Contractor** shall be liable for such difference in price for the entire amount of supplies required by the **Agency** for the uncompleted term of **Contractor's Contract**. In the case of a construction **Contract**, the **Agency** shall also have the right to hold the **Contractor** in partial or total default in accordance with the default provisions of this **Contract**, and/or may seek debarment or suspension of the **Contractor**. The rights and remedies of the **Agency** hereunder shall be in addition to, and not in lieu of, any rights and remedies the **Agency** has pursuant to this **Contract** or by operation of **Law**.

ARTICLE 70. ELECTRONIC FILING/NYC DEVELOPMENT HUB

70.1 The **Contractor** shall electronically file all alteration type-2 and alteration type-3 applications via the New York City Development Hub Web site, except applications for the following types of minor alterations: enlargements, curb cuts, legalizations, fire alarms, builders pavement plans, and jobs filed on Landmark Preservation Commission calendared properties. All such filings must be professionally certified. Information about electronic filing via the New York City Development Hub is available on the **City** Department of Buildings Web site at www.nyc.gov/buildings.

ARTICLE 71. PROHIBITION OF TROPICAL HARDWOODS

71.1 Tropical hardwoods, as defined in Section 165 of the New York State Finance Law (Finance Law), shall not be utilized in the performance of this **Contract** except as expressly permitted by Section 165 of the Finance Law.

ARTICLE 72. CONFLICTS OF INTEREST

72.1 Section 2604 of the **City** Charter and other related provisions of the **City** Charter, the Administrative Code, and the Penal Law are applicable under the terms of this **Contract** in relation to conflicts of interest and shall be extended to **Subcontractors** authorized to perform **Work**, labor and services pursuant to this **Contract** and further, it shall be the duty and responsibility of the **Contractor** to so inform its respective **Subcontractors**. Notice is hereby given that, under certain circumstances, penalties may be invoked against the donor as well as the recipient of any form of valuable gift.

ARTICLE 73. MERGER CLAUSE

73.1 The written **Contract** herein, contains all the terms and conditions agreed upon by the parties hereto, and no other agreement, oral or otherwise, regarding the subject matter of this **Contract** shall be deemed to exist or to bind any of the parties hereto, or to vary any of the terms contained herein.

ARTICLE 74. STATEMENT OF WORK

74.1 The **Contractor** shall furnish all labor and materials and perform all **Work** in strict accordance with the **Specifications** and **Addenda** thereto, numbered as shown in Schedule A.

ARTICLE 75. COMPENSATION TO BE PAID TO CONTRACTOR

75.1 The **City** will pay and the **Contractor** will accept in full consideration for the performance of the **Contract**, subject to additions and deductions as provided herein, the total sum shown in Schedule A, this said sum being the amount at which the **Contract** was awarded to the **Contractor** at a public letting thereof, based upon the **Contractor's** bid for the **Contract**.

ARTICLE 76. ELECTRONIC FUNDS TRANSFER

76.1 In accordance with Section 6-107.1 of the Administrative Code, the **Contractor** agrees to accept payments under this **Contract** from the **City** by electronic funds transfer (EFT). An EFT is any

transfer of funds, other than a transaction originated by check, draft or similar paper instrument, which is initiated through an electronic terminal, telephonic instrument or computer or magnetic tape so as to order, instruct or authorize a financial institution to debit or credit an account. Prior to the first payment made under this **Contract**, the **Contractor** shall designate one financial institution or other authorized payment agent and shall complete the attached "EFT Vendor Payment Enrollment Form" in order to provide the Commissioner of the **City** Department of Finance with information necessary for the **Contractor** to receive electronic funds transfer payments through a designated financial institution or authorized payment agent. The crediting of the amount of a payment to the appropriate account on the books of a financial institution or other authorized payment agent designated by the **Contractor** shall constitute full satisfaction by the **City** for the amount of the payment under this **Contract**. The account information supplied by the **Contractor** to facilitate the electronic funds transfer shall remain confidential to the fullest extent provided by **Law**.

76.2 The **Commissioner** may waive the application of the requirements of this Article 76 to payments on contracts entered into pursuant to Section 315 of the **City** Charter. In addition, the Commissioner of the Department of Finance and the Comptroller may jointly issue standards pursuant to which the **Agency** may waive the requirements of this Article 76 for payments in the following circumstances: (i) for individuals or classes of individuals for whom compliance imposes a hardship; (ii) for classifications or types of checks; or (iii) in other circumstances as may be necessary in the interest of the **City**.

ARTICLE 77. RECORDS RETENTION

77.1 The **Contractor** agrees to retain all books, records, and other documents relevant to this **Contract** for six years after the final payment or termination of this **Contract**, whichever is later. **City**, state, and federal auditors and any other persons duly authorized by the **City** shall have full access to and the right to examine any such books, records, and other documents during the retention period.

ARTICLE 78. EXAMINATION AND VIEWING OF SITE, CONSIDERATION OF OTHER SOURCES OF INFORMATION AND CHANGED SITE CONDITIONS

78.1 Pre-Bidding (Investigation) Viewing of Site – Bidders must carefully view and examine the **Site** of the proposed **Work**, as well as its adjacent area, and seek other usual sources of information, for they will be conclusively presumed to have full knowledge of any and all conditions and hazards on, about or above the **Site** relating to or affecting in any way the performance of the **Work** to be done under the **Contract** that were or should have been known by a reasonably prudent bidder. To arrange a date for visiting the **Site**, bidders are to contact the **Agency** contact person specified in the bid documents.

78.2 Should the **Contractor** encounter during the progress of the Work site conditions or environmental hazards at the **Site** materially differing from any shown on the **Contract Drawings** or indicated in the **Specifications** or such conditions or environmental hazards as could not reasonably have been anticipated by the **Contractor**, which conditions or hazards will materially affect the cost of the **Work** to be done under the **Contract**, the attention of the **Commissioner** must be called immediately to such conditions or hazards before they are disturbed. The **Commissioner** shall thereupon promptly investigate the conditions or hazards. If the **Commissioner** finds that they do so materially differ, and that they could not have been reasonably anticipated by the **Contractor**, the **Contract** may be modified with the **Commissioner**'s written approval.

ARTICLE 79. PARTICIPATION BY MINORITY-OWNED AND WOMEN-OWNED BUSINESS ENTERPRISES IN CITY PROCUREMENT

NOTICE TO ALL PROSPECTIVE CONTRACTORS

ARTICLE I. M/WBE PROGRAM

Local Law No. 129 of 2005 added and Local Law 1 of 2013 amended Section 6-129 of the Administrative Code of the City of New York (hereinafter "Section 6-129"). Section 6-129 establishes the program for participation in City procurement ("M/WBE Program") by minority- owned business enterprises ("MBEs") and women-owned business enterprises ("WBEs"), certified in accordance with Section 1304 of the New York City Charter. As stated in Section 6-129, the intent of the program is to address the impact of discrimination on the City's procurement process, and to promote the public interest in avoiding fraud and favoritism in the procurement process, increasing competition for City business, and lowering contract costs. The contract provisions contained herein are pursuant to Section 6-129, and the rules of the Department of Small Business Services ("DSBS") promulgated thereunder.

If this Contract is subject to the M/WBE Program established by Section 6-129, the specific requirements of MBE and/or WBE participation for this Contract are set forth in Schedule B of the Contract (entitled the "M/WBE Utilization Plan"), and are detailed below. The Contractor must comply with all applicable MBE and WBE requirements for this Contract.

All provisions of Section 6-129 are hereby incorporated in the Contract by reference and all terms used herein that are not defined herein shall have the meanings given such terms in Section 6-129. Article I, Part A, below, sets forth provisions related to the participation goals for construction, standard and professional services contracts. Article I, Part B, below, sets forth miscellaneous provisions related to the M/WBE Program.

PART A

PARTICIPATION GOALS FOR CONSTRUCTION, STANDARD AND PROFESSIONAL SERVICES CONTRACTS OR TASK ORDERS

1. The **MBE and/or WBE Participation Goals** established for this Contract or Task Orders issued pursuant to this Contract, ("**Participation Goals**"), as applicable, are set forth on Schedule B, Part I to this Contract (see Page 1, line 1 Total Participation Goals) or will be set forth on Schedule B, Part I to Task Orders issued pursuant to this Contract, as applicable.

The **Participation Goals** represent a percentage of the total dollar value of the Contract or Task Order, as applicable, that may be achieved by awarding subcontracts to firms certified with New York City Department of Small Business Services as MBEs and/or WBEs, and/or by crediting the participation of prime contractors and/or qualified joint ventures as provided in Section 3 below, unless the goals have been waived or modified by Agency in accordance with Section 6-129 and Part A, Sections 10 and 11 below, respectively.

2. If **Participation Goals** have been established for this Contract or Task Orders issued pursuant to this Contract, Contractor agrees or shall agree as a material term of the Contract that Contractor shall be subject to the **Participation Goals**, unless the goals are waived or modified by Agency in accordance with Section 6-129 and Part A, Sections 10 and 11 below, respectively.

3. If **Participation Goals** have been established for this Contract or Task Order issued pursuant to this Contract, a Contractor that is an MBE and/or WBE shall be permitted to count its own participation toward fulfillment of the relevant **Participation Goal**, provided that in accordance with Section 6-129 the value of Contractor's participation shall be determined by subtracting from the total value of the Contract or Task Order, as applicable, any amounts that the Contractor pays to direct subcontractors (as defined in Section 6-129(c)(13)), and provided further that a Contractor that is certified as both an MBE and a WBE may count its own participation either toward the goal for MBEs or the goal for WBEs, but not both.

A Contractor that is a qualified joint venture (as defined in Section 6-129(c)(30)) shall be permitted to count a percentage of its own participation toward fulfillment of the relevant **Participation Goal**. In accordance with Section 6-129, the value of Contractor's participation shall be determined by subtracting from the total value of the Contract or Task Order, as applicable, any amounts that Contractor pays to direct subcontractors, and then multiplying the remainder by the percentage to be applied to total profit to determine the amount to which an MBE or WBE is entitled pursuant to the joint venture agreement, provided that where a participant in a joint venture is certified as both an MBE and a WBE, such amount shall be counted either toward the goal for MBEs or the goal for WBEs, but not both.

4. A. If **Participation Goals** have been established for this Contract, a prospective contractor shall be required to submit with its bid or proposal, as applicable, a completed Schedule B, M/WBE Utilization Plan, Part II (see Pages 2-4) indicating: (a) whether the contractor is an MBE or WBE, or qualified joint venture; (b) the percentage of work it intends to award to direct subcontractors; and (c) in cases where the contractor intends to award direct subcontracts, a description of the type and dollar value of work designated for participation by MBEs and/or WBEs, and the time frames in which such work is scheduled to begin and end. In the event that this M/WBE Utilization Plan indicates that the bidder or proposer, as applicable, does not intend to meet the **Participation Goals**, the bid or proposal, as applicable, shall be deemed non-responsive, unless Agency has granted the bidder or proposer, as applicable, a pre- award waiver of the Participation Goals in accordance with Section 6-129 and Part A, Section 10 below.

B. (i) If this Contract is for a master services agreement or other requirements type contract that will result in the issuance of Task Orders that will be individually registered ("Master Services Agreement") and is subject to M/WBE **Participation Goals**, a prospective contractor shall be required to submit with its bid or proposal, as applicable, a completed Schedule B, M/WBE Participation Requirements for Master Services Agreements That Will Require Individually Registered Task Orders, Part II (page 2) indicating the prospective contractor's certification and required affirmations to make all reasonable good faith efforts to meet participation goals established on each individual Task Order issued pursuant to this Contract, or if a partial waiver is obtained or such goals are modified by the Agency, to meet the modified **Participation Goals** by soliciting and obtaining the participation of certified MBE and/or WBE firms. In the event that the Schedule B indicates that the bidder or proposer, as applicable, does not intend to meet the **Participation Goals** that may be established on Task Orders issued pursuant to this Contract, the bid or proposal, as applicable, shall be deemed nonresponsive.

(ii) **Participation Goals** on a Master Services Agreement will be established for individual Task Orders issued after the Master Services Agreement is awarded. If **Participation Goals** have been established on a Task Order, a contractor shall be required to submit a Schedule B – M/WBE Utilization Plan For Independently Registered Task Orders That Are Issued Pursuant to Master Services Agreements, Part II (see Pages 2-4) indicating: (a) whether the contractor is an MBE or WBE, or qualified joint venture; (b) the percentage of work it intends to award to direct subcontractors; and (c) in cases where the contractor intends to award direct subcontracts, a description of the type and dollar value of work designated for participation by MBEs and/or WBEs, and the time frames in which such work is scheduled to begin and end. The contractor must engage in good faith efforts to meet the **Participation Goals** as established for the Task Order unless Agency has granted the contractor a pre-award waiver of the Participation Goals in accordance with Section 6-129 and Part A, Section 10 below.

C. THE BIDDER/PROPOSER MUST COMPLETE THE SCHEDULE B INCLUDED HEREIN (SCHEDULE B, PART II). A SCHEDULE B SUBMITTED BY THE BIDDER/PROPOSER WHICH DOES NOT INCLUDE THE VENDOR CERTIFICATION AND REQUIRED AFFIRMATIONS (SEE SECTION V OF PART II) WILL BE DEEMED TO BE NON-RESPONSIVE, UNLESS A FULL WAIVER OF THE PARTICIPATION GOALS IS GRANTED (SCHEDULE B, PART III). IN THE EVENT THAT THE CITY DETERMINES THAT THE BIDDER/PROPOSER HAS SUBMITTED A SCHEDULE B WHERE THE VENDOR CERTIFICATION AND REQUIRED AFFIRMATIONS ARE COMPLETED BUT OTHER ASPECTS OF THE SCHEDULE B ARE NOT COMPLETE, OR CONTAIN A COPY OR COMPUTATION ERROR THAT IS AT ODDS WITH THE VENDOR CERTIFICATION AND AFFIRMATIONS, THE BIDDER/PROPOSER WILL BE NOTIFIED BY THE AGENCY AND WILL BE GIVEN FOUR (4) CALENDAR DAYS FROM RECEIPT OF NOTIFICATION TO CURE THE SPECIFIED DEFICIENCIES AND RETURN A COMPLETED SCHEDULE B TO THE AGENCY. FAILURE TO DO SO WILL RESULT IN A DETERMINATION THAT THE BID/PROPOSAL IS NON-RESPONSIVE. RECEIPT OF NOTIFICATION IS DEFINED AS THE DATE NOTICE IS E-MAILED OR FAXED (IF THE BIDDER/PROPOSER HAS PROVIDED AN E-MAIL ADDRESS OR FAX NUMBER), OR NO LATER THAN FIVE (5) CALENDAR DAYS FROM THE DATE OF MAILING OR UPON DELIVERY, IF DELIVERED.

5. Where an **M/WBE** Utilization Plan has been submitted, the Contractor shall, within 30 days of issuance by Agency of a notice to proceed, submit a list of proposed persons or entities to which it intends to award subcontracts within the subsequent 12 months. In the case of multiyear contracts, such list shall also be submitted every year thereafter. The Agency may also require the Contractor to report periodically about the contracts awarded by its direct subcontractors to indirect subcontractors (as defined in Section 6-129(c)(22)). **PLEASE NOTE: If this Contract is a public works project subject to GML §101(5) (i.e., a contract valued at or below $3M for projects in New York City) or if the Contract is subject to a project labor agreement in accordance with Labor Law §222, and the bidder is required to identify at the time of bid submission its intended subcontractors for the Wicks trades (plumbing and gas fitting; steam heating, hot water heating, ventilating and air conditioning (HVAC); and electric wiring), the Contractor must identify all those to which it intends to award construction subcontracts for any portion of the Wicks trade work at the time of bid submission, regardless of what point in the life of the contract such subcontracts will occur. In identifying intended subcontractors in the bid submission, bidders may satisfy any Participation Goals established for this Contract by proposing one or more subcontractors that are MBEs and/or WBEs for any portion of the Wicks trade work.** In the event that the Contractor's selection of a subcontractor is disapproved, the Contractor shall have a reasonable time to propose alternate subcontractors.

6. MBE and WBE firms must be certified by DSBS in order for the Contractor to credit such firms' participation toward the attainment of the **Participation Goals**. Such certification must occur prior to the

firms' commencement of work. A list of MBE and WBE firms may be obtained from the DSBS website at www.nyc.gov/buycertified, by emailing DSBS at buyer@sbs.nyc.gov, by calling (212) 513-6356, or by visiting or writing DSBS at 110 William St., New York, New York, 10038, 7th floor. Eligible firms that have not yet been certified may contact DSBS in order to seek certification by visiting www.nyc.gov/getcertified, emailing MWBE@sbs.nyc.gov, or calling the DSBS certification helpline at (212) 513-6311. A firm that is certified as both an MBE and a WBE may be counted either toward the goal for MBEs or the goal for WBEs, but not both. No credit shall be given for participation by a graduate MBE or graduate WBE, as defined in Section 6-129(c)(20).

7. Where an **M/WBE** Utilization Plan has been submitted, the Contractor shall, with each voucher for payment, and/or periodically as Agency may require, submit statements, certified under penalty of perjury, which shall include, but not be limited to,: the total amount the Contractor paid to its direct subcontractors, and, where applicable pursuant to Section 6-129(j), the total amount direct subcontractors paid to indirect subcontractors; the names, addresses and contact numbers of each MBE or WBE hired as a subcontractor by the Contractor, and, where applicable, hired by any of the Contractor's direct subcontractors; and the dates and amounts paid to each MBE or WBE. The Contractor shall also submit, along with its voucher for final payment: the total amount it paid to subcontractors, and, where applicable pursuant to Section 6-129(j), the total amount its direct subcontractors paid directly to their indirect subcontractors; and a final list, certified under penalty of perjury, which shall include the name, address and contact information of each subcontractor that is an MBE or WBE, the work performed by, and the dates and amounts paid to each.

8. If payments made to, or work performed by, MBEs or WBEs are less than the amount specified in the Contractor's **M/WBE** Utilization Plan, Agency shall take appropriate action, in accordance with Section 6-129 and Article II below, unless the Contractor has obtained a modification of its **M/WBE** Utilization Plan in accordance with Section 6-129 and Part A, Section 11 below.

9. Where an **M/WBE** Utilization Plan has been submitted, and the Contractor requests a change order the value of which exceeds the greater of 10 percent of the Contract or Task Order, as applicable, or $500,000, Agency shall review the scope of work for the Contract or Task Order, as applicable, and the scale and types of work involved in the change order, and determine whether the **Participation Goals** should be modified.

10. Pre-award waiver of the **Participation Goals**. (a) A bidder or proposer, or contractor with respect to a Task Order, may seek a pre-award full or partial waiver of the **Participation Goals** in accordance with Section 6-129, which requests that Agency change one or more **Participation Goals** on the grounds that the **Participation Goals** are unreasonable in light of the availability of certified firms to perform the services required, or by demonstrating that it has legitimate business reasons for proposing a lower level of subcontracting in its M/WBE Utilization Plan.

(b) To apply for a full or partial waiver of the **Participation Goals**, a bidder, proposer, or contractor, as applicable, must complete Part III (Page 5) of Schedule B and submit such request no later than seven (7) calendar days prior to the date and time the bids, proposals, or Task Orders are due, in writing to the Agency by email at poped@ddc.nyc.gov or via facsimile at (718) 391-1886. Bidders, proposers, or contractors, as applicable, who have submitted requests will receive an Agency response by no later than two (2) calendar days prior to the due date for bids, proposals, or Task Orders; provided, however, that if that date would fall on a weekend or holiday, an Agency response will be provided by close-of-business on the business day before such weekend or holiday date.

(c) If the Agency determines that the **Participation Goals** are unreasonable in light of the availability of certified firms to perform the services required, it shall revise the solicitation and extend the deadline for bids and proposals, or revise the Task Order, as applicable.

(d) Agency may grant a full or partial waiver of the **Participation Goals** to a bidder, proposer or contractor, as applicable, who demonstrates—before submission of the bid, proposal or Task Order, as applicable—that it has legitimate business reasons for proposing the level of subcontracting in its **M/WBE** Utilization Plan. In making its determination, Agency shall consider factors that shall include, but not be limited to, whether the bidder, proposer or contractor, as applicable, has the capacity and the bona fide intention to perform the Contract without any subcontracting, or to perform the Contract without awarding the amount of subcontracts represented by the **Participation Goals**. In making such determination, Agency may consider whether the **M/WBE** Utilization Plan is consistent with past subcontracting practices of the bidder, proposer or contractor, as applicable, whether the bidder, proposer or contractor, as applicable, has made efforts to form a joint venture with a certified firm, and whether the bidder, proposer, or contractor, as applicable, has made good faith efforts to identify other portions of the Contract that it intends to subcontract.

11. Modification of **M/WBE** Utilization Plan. (a) A Contractor may request a modification of its **M/WBE** Utilization Plan after award of this Contract. **PLEASE NOTE: If this Contract is a public works project subject to GML §101(5) (i.e., a contract valued at or below $3M for projects in New York City) or if the Contract is subject to a project labor agreement in accordance with Labor Law §222, and the bidder is required to identify at the time of bid submission its intended subcontractors for the Wicks trades (plumbing and gas fitting; steam heating, hot water heating, ventilating and air conditioning (HVAC); and electric wiring), the Contractor may request a Modification of its M/WBE Utilization Plan as part of its bid submission.** The Agency may grant a request for Modification of a Contractor's **M/WBE** Utilization Plan if it determines that the Contractor has established, with appropriate documentary and other evidence, that it made reasonable, good faith efforts to meet the **Participation Goals.** In making such determination, Agency shall consider evidence of the following efforts, as applicable, along with any other relevant factors:

(i) The Contractor advertised opportunities to participate in the Contract, where appropriate, in general circulation media, trade and professional association publications and small business media, and publications of minority and women's business organizations;
(ii) The Contractor provided notice of specific opportunities to participate in the Contract, in a timely manner, to minority and women's business organizations;
(iii) The Contractor sent written notices, by certified mail or facsimile, in a timely manner, to advise MBEs or WBEs that their interest in the Contract was solicited;
(iv) The Contractor made efforts to identify portions of the work that could be substituted for portions originally designated for participation by MBEs and/or WBEs in the M/WBE Utilization Plan, and for which the Contractor claims an inability to retain MBEs or WBEs;
(v) The Contractor held meetings with MBEs and/or WBEs prior to the date their bids or proposals were due, for the purpose of explaining in detail the scope and requirements of the work for which their bids or proposals were solicited;
(vi) The Contractor made efforts to negotiate with MBEs and/or WBEs as relevant to perform specific subcontracts, or act as suppliers or service providers;
(vii) Timely written requests for assistance made by the Contractor to Agency's M/WBE liaison officer and to DSBS;
(viii) Description of how recommendations made by DSBS and Agency were acted upon and an explanation of why action upon such recommendations did not lead to the desired level of participation of MBEs and/or WBEs.

Agency's M/WBE officer shall provide written notice to the Contractor of the determination.

(b) The Agency may modify the **Participation Goals** when the scope of the work has been changed by the Agency in a manner that affects the scale and types of work that the Contractor indicated in its **M/WBE** Utilization Plan would be awarded to subcontractors.

12. If this Contract is for an indefinite quantity of construction, standard or professional services or is a requirements type contract and the Contractor has submitted an **M/WBE** Utilization Plan and has committed to subcontract work to MBEs and/or WBEs in order to meet the **Participation Goals**, the Contractor will not be deemed in violation of the M/WBE Program requirements for this Contract with regard to any work which was intended to be subcontracted to an MBE and/or WBE to the extent that the Agency has determined that such work is not needed.

13. If **Participation Goals** have been established for this Contract or a Task Order issued pursuant to this Contract, at least once annually during the term of the Contract or Task Order, as applicable, Agency shall review the Contractor's progress toward attainment of its M/WBE Utilization Plan, including but not limited to, by reviewing the percentage of work the Contractor has actually awarded to MBE and/or WBE subcontractors and the payments the Contractor made to such subcontractors.

14. If **Participation Goals** have been established for this Contract or a Task Order issued pursuant to this Contract, Agency shall evaluate and assess the Contractor's performance in meeting those goals, and such evaluation and assessment shall become part of the Contractor's overall contract performance evaluation.

PART B: MISCELLANEOUS

1. The Contractor shall take notice that, if this solicitation requires the establishment of an **M/WBE** Utilization Plan, the resulting contract may be audited by DSBS to determine compliance with Section 6-129. See §6-129(e)(10). Furthermore, such resulting contract may also be examined by the City's Comptroller to assess compliance with the **M/WBE** Utilization Plan.

2. Pursuant to DSBS rules, construction contracts that include a requirement for an **M/WBE** Utilization Plan shall not be subject to the law governing Locally Based Enterprises set forth in Section 6-108.1 of the Administrative Code of the City of New York.

3. DSBS is available to assist contractors and potential contractors in determining the availability of MBEs and/or WBEs to participate as subcontractors, and in identifying opportunities that are appropriate for participation by MBEs and/or WBEs in contracts.

4. Prospective contractors are encouraged to enter into qualified joint venture agreements with MBEs and/or WBEs as defined by Section 6-129(c)(30).

5. By submitting a bid or proposal the Contractor hereby acknowledges its understanding of the M/WBE Program requirements set forth herein and the pertinent provisions of Section 6-129, and any rules promulgated thereunder, and if awarded this Contract, the Contractor hereby agrees to comply with the M/WBE Program requirements of this Contract and pertinent provisions of Section 6-129, and any rules promulgated thereunder, all of which shall be deemed to be material terms of this Contract. The Contractor hereby agrees to make all reasonable, good faith efforts to solicit and obtain the participation of MBEs and/or WBEs to meet the required **Participation Goals**.

ARTICLE II. ENFORCEMENT

1. If Agency determines that a bidder or proposer, as applicable, has, in relation to this procurement, violated Section 6-129 or the DSBS rules promulgated pursuant to Section 6-129, Agency may disqualify such bidder or proposer, as applicable, from competing for this Contract and the Agency may revoke such bidder's or proposer's prequalification status, if applicable.

2. Whenever Agency believes that the Contractor or a subcontractor is not in compliance with Section 6-129 or the DSBS rules promulgated pursuant to Section 6-129, or any provision of this Contract that implements Section 6-129, including, but not limited to any **M/WBE** Utilization Plan, Agency shall send a written notice to the Contractor describing the alleged noncompliance and offering the Contractor an opportunity to be heard. Agency shall then conduct an investigation to determine whether such Contractor or subcontractor is in compliance.

3. In the event that the Contractor has been found to have violated Section 6-129, the DSBS rules promulgated pursuant to Section 6-129, or any provision of this Contract that implements Section 6-129, including, but not limited to, any **M/WBE** Utilization Plan, Agency may determine that one of the following actions should be taken:

(a) entering into an agreement with the Contractor allowing the Contractor to cure the violation;
(b) revoking the Contractor's pre-qualification to bid or make proposals for future contracts;
(c) making a finding that the Contractor is in default of the Contract;
(d) terminating the Contract;
(e) declaring the Contractor to be in breach of Contract;
(f) withholding payment or reimbursement;
(g) determining not to renew the Contract;
(h) assessing actual and consequential damages;
(i) assessing liquidated damages or reducing fees, provided that liquidated damages may be based on amounts representing costs of delays in carrying out the purposes of the M/WBE Program, or in meeting the purposes of the Contract, the costs of meeting utilization goals through additional procurements, the administrative costs of investigation and enforcement, or other factors set forth in the Contract;
(j) exercising rights under the Contract to procure goods, services or construction from another contractor and charge the cost of such contract to the Contractor that has been found to be in noncompliance; or
(k) taking any other appropriate remedy.

4. If an **M/WBE** Utilization Plan has been submitted, and pursuant to this Article II, Section 3, the Contractor has been found to have failed to fulfill its **Participation Goals** contained in its **M/WBE** Utilization Plan or the **Participation Goals** as modified by Agency pursuant to Article I, Part A, Section 11, Agency may assess liquidated damages in the amount of ten percent (10%) of the difference between the dollar amount of work required to be awarded to MBE and/or WBE firms to meet the **Participation Goals** and the dollar amount the Contractor actually awarded and paid, and/or credited, to MBE and/or WBE firms. In view of the difficulty of accurately ascertaining the loss which the City will suffer by reason of Contractor's failure to meet the **Participation Goals**, the foregoing amount is hereby fixed and agreed as the liquidated damages that the City will suffer by reason of such failure, and not as a penalty. Agency may deduct and retain out of any monies which may become due under this Contract the amount of any such liquidated damages; and in case the amount which may become due under this Contract shall be less than the amount of liquidated damages suffered by the City, the Contractor shall be liable to pay the difference.

5. Whenever Agency has reason to believe that an MBE and/or WBE is not qualified for certification, or is participating in a contract in a manner that does not serve a commercially useful function (as defined in Section 6-129(c)(8)), or has violated any provision of Section 6- 129, Agency shall notify the Commissioner of DSBS who shall determine whether the certification of such business enterprise should be revoked.

6. Statements made in any instrument submitted to Agency pursuant to Section 6-129 shall be submitted under penalty of perjury and any false or misleading statement or omission shall be grounds for the application of any applicable criminal and/or civil penalties for perjury. The making of a false or fraudulent statement by an MBE and/or WBE in any instrument submitted pursuant to Section 6-129 shall, in addition, be grounds for revocation of its certification.

7. The Contractor's record in implementing its **M/WBE** Utilization Plan shall be a factor in the evaluation of its performance. Whenever Agency determines that a Contractor's compliance with an **M/WBE** Utilization Plan has been unsatisfactory, Agency shall, after consultation with the City Chief Procurement Officer, file an advice of caution form for inclusion in VENDEX as caution data.

IN WITNESS WHEREOF, the Commissioner, on behalf of the City of New York, and the Contractor, have executed this agreement in quadruplicate, two parts of which are to remain with the Commissioner, another to be filed with the Comptroller of the City, and the fourth to be delivered to the Contractor.

THE CITY OF NEW YORK

By:_____
Deputy Commissioner

CONTRACTOR:

By:_____
(Member of Firm or Officer of Corporation)

Title: Sec. Hres

(Where Contractor is a Corporation, add):
Attest:

_____
Secretary

(Seal)

_____

ACKNOWLEDGEMENT OF PRINCIPAL, IF A CORPORATION

State of New York County of Queens ss:

On this 9th day of August, 2018, before me personally came Antimo Massaro to me known who, being by me duly sworn did depose and say that he resides at Laurel Hollow, NY that he is the Secretary/Treasurer of the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation; that one of the seals affixed to said instrument is such seal; that it was so affixed by order of the directors of said corporation, and that he signed his name thereto by like order.

VICTORIA AYO-VAUGHAN
Notary Public, State of New York
Registration #01AY5014042
Qualified in Queens County
Commission Expires July 15, 2019

Notary Public or Commissioner of Deeds

ACKNOWLEDGEMENT OF PRINCIPAL, IF A PARTNERSHIP

State of _____ County of _____ ss:

On this _____ day of _____, _____, before me personally appeared _____ to me known, and known to me to be one of the members of the firm of _____ described in and who executed the foregoing instrument; and he acknowledged to me that he executed the same as and for the act and deed of said firm.

Notary Public or Commissioner of Deeds

ACKNOWLEDGEMENT OF PRINCIPAL, IF AN INDIVIDUAL

State of _____ County of _____ ss:

On this _____ day of _____, _____, before me personally appeared _____ to me known, and known to me to be the person described in and who executed the foregoing instrument; and acknowledged that he executed the same.

Notary Public or Commissioner of Deeds

ACKNOWLEDGEMENT BY COMMISSIONER

State of New York County of Queens ss:

On this 14th day of August, 2018, before me personally came Tom Foley to me known, and known to be the Deputy Commissioner of the Department of Design and Construction of The City of New York, the person described as such in and who as such executed the foregoing instrument and acknowledged to me that he executed the same as Deputy Commissioner for the purposes therein mentioned.

Notary Public or Commissioner of Deeds

VICTORIA AYO-VAUGHAN
Notary Public, State of New York
Registration #01AY5014042
Qualified in Queens County
Commission Expires July 15, 2019

AUTHORITY

MAYOR'S CERTIFICATE NO. CBX DATED
BUDGET DIRECTOR'S CERTIFICATE NO. DATED

APPROPRIATION
COMMISSIONER'S CERTIFICATE

In conformity with the provisions of Section 6-101 of the Administrative Code of the City of New York, it is hereby certified that the estimated cost of the work, materials and supplies required by the within Contract, amounting to

eighty three million eight hundred twenty four thousand five hundred seventy four

Dollars ($ 83,824,574.00)

is chargeable to the fund of the Department of Design and Construction entitled Code

_____

_____

_____
Department of Design and Construction

I hereby certify that the specifications contained herein comply with the terms and conditions of the BUDGET.

_____
Deputy Commissioner

COMPTROLLER'S CERTIFICATE

The City of New York_____

Pursuant to the provisions of Section 6-101 of the Administrative Code of the City of New York, I hereby certify that there remains unapplied and unexpended a balance of the above mentioned fund applicable to this Contract sufficient to pay the estimated expense of executing the same viz:

$_____

_____
Comptroller

MAYOR'S CERTIFICATE OR CERTIFICATE OF THE DIRECTOR OF THE BUDGET

Bond No. SU1146881
Executed in Duplicate

Performance Bond #2 (Pages 104 to 107): Use if the total contract price is more than $5 Million.

PERFORMANCE BOND #2

KNOW ALL PERSONS BY THESE PRESENTS:,
That we, _____

C & L Contracting Corp.
1981 Marcus Ave., Ste E106, Lake Success, NY 11042

hereinafter referred to as the "Principal,"
and, _____

Arch Insurance Company
3 Parkway, Ste 1500, Philadelphia, PA 19102

hereinafter referred to as the "Surety" ("Sureties") are held and firmly bound to THE CITY OF NEW YORK, hereinafter referred to as the "City" or to its successors and assigns in the penal sum
of _____

Eighty Three Million Eight Hundred Twenty Four Thousand Five Hundred Seventy Four and 00/100

($ 83,824,574.00) Dollars, lawful money of the United States for the payment of which said sum of money well and truly to be made, we, and each of us, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal is about to enter, or has entered, into a Contract in writing with the City for

Croton New Above Ground Structure and Landscaping, Borough of the Bronx; FMS# CRO-AGS

a copy of which Contract is annexed to and hereby made a part of this bond as though herein set forth in full;

NOW, THEREFORE, the conditions of this obligation are such that if the Principal, his or its representatives or assigns, shall well and faithfully perform the said Contract and all modifications, amendments, additions and alterations thereto that may hereafter be made, according to its terms and its true intent and meaning, including repair and or replacement of defective work and guarantees of maintenance for the periods stated in the Contract, and shall fully indemnify and save harmless the City from all cost and damage which it may suffer by reason of the Principal's default of the Contract, and shall fully reimburse and repay the City for all outlay and expense which the City may incur in making

Performance Bond #2 (Pages 104 to 107): Use if the total contract price is more than $5 Million.

good any such default and shall protect the said City of New York against, and pay any and all amounts, damages, cost and judgments which may or shall be recovered against said City or its officers or agents or which the said City of New York may be called upon to pay any person or corporation by reason of any damages arising or growing out of the Principal's default of the Contract, then this obligation shall be null and void, otherwise to remain in full force and effect.

The Surety (Sureties), for value received, hereby stipulates and agrees, upon written notice from the City that the City has determined that the Principal is in default of the Contract, to either (1) pay the full amount of the above penal sum in complete discharge and exoneration of this bond and of all the liabilities of the Surety relating to this bond, or (2) fully perform and complete the Work to be performed under the Contract, pursuant to the terms, conditions, and covenants thereof. The Surety (Sureties) further agrees, at its option, either to tender the penal sum or to commence and diligently perform the Work specified in the Contract, including physical site work, within twenty-five (25) business days after written notice thereof from the City and to complete all Work within the time set forth in the Contract or such other time as agreed to between the City and Surety in accordance with the Contract. The Surety and the City reserve all rights and defenses each may have against the other; provided, however, that the Surety expressly agrees that its reservation of rights shall not provide a basis for non-performance of its obligation to commence and to complete all Work as provided herein.

The Surety (Sureties), for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of said Surety (Sureties) and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition, or change in or to the said Contract or the Work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any Work to be performed or any moneys due or to become due thereunder; and said Surety (Sureties) does hereby waive notice of any and all of such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to said Surety (Sureties) as though done or omitted to be done by or in relation to said Principal.

Performance Bond #2 (Pages 104 to 107): Use if the total contract price is more than $5 Million.

IN WITNESS WHEREOF, The Principal and the Surety (Sureties) have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereunto affixed and these presents to be signed by their proper officers, this

6th day of August 20 18.

(Seal)

C & L Contracting Corp. (L.S.)

Principal

By: _____.

(Seal)

Surety

Arch Insurance Company

By: _____.

Victoria P. Parkerson, Attorney-in-Fact

(Seal)

Surety

By: _____.

_____.

(Seal)

Surety

By: _____.

_____.

(Seal)

Surety

By: _____.

_____.

(Seal)

Surety

By: _____.

Bond Premium Rate $12 slide.

Bond Premium Cost $501,417.00.

If the Contractor (Principal) is a partnership, the bond should be signed by each of the individuals who are partners.

If the Contractor (Principal) is a corporation, the bond should be signed in its correct corporate name by a duly authorized officer, agent, or attorney-in-fact.

There should be executed an appropriate number of counterparts of the bond corresponding to the number of counterparts of the Contract.

Performance Bond #2 (Pages 104 to 107): Use if the total contract price is more than $5 Million.

ACKNOWLEDGMENT OF PRINCIPAL IF A CORPORATION

State of New York County of Nassau ss:

On this 8 day of August, 20 18 before me personally came Tony Massaro, to me known, who, being by me duly sworn did depose and say that he resides at 225 Laurel Lane, Laurel Hollow NY 11791; that he/she is the Sec/Tres of the corporation described in and which executed the foregoing instrument; that he/she signed his/her name to the foregoing instrument by order of the directors of said corporation as the duly authorized and binding act thereof.

JENNIFER M DAVIS
Notary Public, State of New York
No. 01DA6326421
Qualified in Nassau County
Commission Expires June 15, 2019

Notary Public or Commissioner of Deeds.

ACKNOWLEDGMENT OF PRINCIPAL IF A PARTNERSHIP

State of _____ County of _____ ss:

On this _____ day of _____, 20 _____ before me personally came _____, to me known, who, being by me duly sworn did depose and say that he/she resides at _____

_____; that he/she is _____ partner of _____, a limited/general partnership existing under the laws of the State of _____, the partnership described in and which executed the foregoing instrument; and that he/she signed his/her name to the foregoing instrument as the duly authorized and binding act of said partnership.

_____
Notary Public or Commissioner of Deeds

ACKNOWLEDGMENT OF PRINCIPAL IF AN INDIVIDUAL

State of _____ County of _____ ss:

On this _____ day of _____, 20_____ before me personally came _____, to me known, who, being by me duly sworn did depose and say that he/she resides at _____

_____, and that he/she is the individual whose name is subscribed to the within instrument and acknowledged to me that by his/her signature on the instrument, said individual executed the instrument.

_____
Notary Public or Commissioner of Deeds

Each executed bond should be accompanied by: (a) appropriate acknowledgments of the respective parties; (b) appropriate duly certified copy of Power of Attorney or other certificate of authority where bond is executed by agent, officer or other representative of Principal or Surety; (c) a duly certified extract from By-Laws or resolutions of Surety under which Power of Attorney or other certificate of authority of its agent, officer or representative was issued, and (d) certified copy of latest published financial statement of assets and liabilities of Surety.

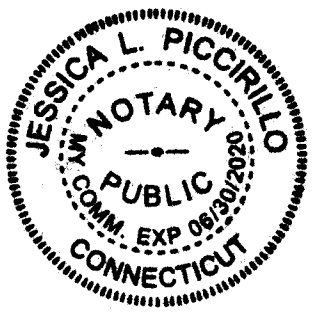
* * * * * * * *

Affix Acknowledgments and Justification of Sureties.

SURETY ACKNOWLEDGMENT

State of Connecticut
County of Hartford Ss.:

On this **6th** day of **August** in the year **2018,** before me personally come(s) **Victoria P. Parkerson** to me know, who, being by me duly sworn, deposes and says that same resides in **Farmington, CT** that same is the **Attorney-in-Fact** of the **Arch Insurance Company** the corporation described in and which executed the foregoing instrument; that same knows the seal of the said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed by the order of the Board of Directors of said corporation and that same signed the name thereto by like order.



Jessica L. Piccirillo
(Signature of Notary taking acknowledgment)

Jessica L. Piccirillo
My comm expires: 6/30/2020

Bond No. SU1146881
Executed in Duplicate

Payment Bond (Pages 108 to 111): Use for any contract for which a Payment Bond is required.

PAYMENT BOND

KNOW ALL PERSONS BY THESE PRESENTS, That we, C & L Contracting Corp. 1981 Marcus Ave., Ste E106, Lake Success, NY 11042

hereinafter referred to as the "Principal", and Arch Insurance Company 3 Parkway, Ste 1500, Philadelphia, PA 19102

hereinafter referred to as the "Surety" ("Sureties") are held and firmly bound to THE CITY OF NEW YORK, hereinafter referred to as the "City" or to its successors and assigns, in the penal sum of

Eighty Three Million Eight Hundred Twenty Four Thousand Five Hundred Seventy Four and 00/100

($ 83,824,574.00) Dollars, lawful money of the United States, for the payment of which said sum of money well and truly to be made, we, and each of us, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal is about to enter, or has entered, into a Contract in writing with the City for

Croton New Above Ground Structure and Landscaping, Borough of the Bronx; FMS# CRO-AGS

a copy of which Contract is annexed to and hereby made a part of this bond as though herein set forth in full;

NOW, THEREFORE, the conditions of this obligation are such that if the Principal, his or its representatives or assigns and other Subcontractors to whom Work under this Contract is sublet and his or their successors and assigns shall promptly pay or cause to be paid all lawful claims for

(a) Wages and compensation for labor performed and services rendered by all persons engaged in the prosecution of the Work under said Contract, and any amendment or extension thereof or addition thereto, whether such persons be agents servants or employees of the Principal or any such Subcontractor, including all persons so engaged who perform the work of laborers or mechanics at or in the vicinity of the site

Payment Bond (Pages 108 to 111): Use for any contract for which a Payment Bond is required.

of the Project regardless of any contractual relationship between the Principal or such Subcontractors, or his or their successors or assigns, on the one hand and such laborers or mechanics on the other, but not including office employees not regularly stationed at the site of the project; and

(b) Materials and supplies (whether incorporated in the permanent structure or not), as well as teams, fuels, oils, implements or machinery furnished, used or consumed by said Principal or any subcontractor at or in the vicinity of the site of the Project in the prosecution of the Work under said Contract and any amendment or extension thereof or addition thereto; then this obligation shall be void, otherwise to remain in full force and effect.

This bond is subject to the following additional conditions, limitations and agreements:

(a) The Principal and Surety (Sureties) agree that this bond shall be for the benefit of any materialmen or laborer having a just claim, as well as the City itself.

(b) All persons who have performed labor, rendered services or furnished materials and supplies, as aforesaid, shall have a direct right of action against the Principal and his, its or their successors and assigns, and the Surety (Sureties) herein, or against either or both or any of them and their successors and assigns. Such persons may sue in their own name, and may prosecute the suit to judgment and execution without the necessity of joining with any other persons as party plaintiff.

(c) The Principal and Surety (Sureties) agree that neither of them will hold the City liable for any judgment for costs of otherwise, obtained by either or both of them against a laborer or materialman in a suit brought by either a laborer or materialman under this bond for moneys allegedly due for performing work or furnishing material.

(d) The Surety (Sureties) or its successors and assigns shall not be liable for any compensation recoverable by an employee or laborer under the Workmen's Compensation Law.

(e) In no event shall the Surety (Sureties), or its successors or assigns, be liable for a greater sum than the penalty of this bond or be subject to any suit, action or proceeding hereon that is instituted by any person, firm, or corporation hereunder later than two years after the complete performance of said Contract and final settlement thereof.

The Principal, for himself and his successors and assigns, and the Surety (Sureties), for itself and its successors and assigns, do hereby expressly waive any objection that might be interposed as to the right of the City to require a bond containing the foregoing provisions, and they do hereby further expressly waive any defense which they or either of them might interpose to an action brought hereon by any person, firm or corporation, including subcontractors, materialmen and third persons, for work, labor, services, supplies or material performed rendered, or furnished as aforesaid upon the ground that there is no law authorizing the City to require the foregoing provisions to be place in this bond.

And the Surety (Sureties), for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of said Surety (Sureties), and its bonds shall be in no way impaired or affected by any extension of time, modification, omission, addition, or change in or of the said Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any part thereof, or of any Work to be performed, or any moneys due to become due thereunder and said Surety (Sureties) does hereby waive notice of any and all of such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers, and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, Subcontractors, and other transferees shall have the same effect as to said Surety (Sureties) as though done or omitted to be done or in relation to said Principal.

Payment Bond (Pages 108 to 111): Use for any contract for which a Payment Bond is required.

IN WITNESS WHEREOF, the Principal and the Surety (Sureties) have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereunto affixed and these presents to be signed by their proper officers, this 6th day of August, 2018.

(Seal) C & L Contracting Corp. (L.S.)
Principal
By: _____

(Seal) Arch Insurance Company
Surety
By: _____
Victoria P. Parkerson, Attorney-in-Fact

(Seal) _____
Surety
By: _____

(Seal) _____
Surety
By: _____

(Seal) _____
Surety
By: _____

If the Contractor (Principal) is a partnership, the bond should be signed by each of the individuals who are partners.

If the Contractor (Principal) is a corporation, the bond should be signed in its correct corporate name by a duly authorized officer, agent, or attorney-in-fact.

There should be executed an appropriate number of counterparts of the bond corresponding to the number of counterparts of the Contract.

Payment Bond (Pages 108 to 111): Use for any contract for which a Payment Bond is required.

ACKNOWLEDGMENT OF PRINCIPAL, IF A CORPORATION

State of New York County of Nassau ss:

On this 8 day of August, 2018, before me personally came Tony Massaro to me known, who, being by me duly sworn did depose and say that he resides at 225 Laurel Lane Laurel Hollow NY 11791 that he is the Sec/Tres of the corporation described in and which executed the foregoing instrument; that he knows the seal of said corporation; that one of the seals affixed to said instrument is such seal; that it was so affixed by order of the directors of said corporation, and that he signed his name thereto by like order.

JENNIFER M DAVIS
Notary Public, State of New York
No. 01DA6326421
Qualified in Nassau County
Commission Expires June 15, 2019

Notary Public or Commissioner of Deeds

ACKNOWLEDGMENT OF PRINCIPAL, IF A PARTNERSHIP

State of _____ County of _____ ss:

On this _____ day of _____, _____, before me personally appeared _____ to me known, and known to me to be one of the members of the firm of _____ _____ described in and who executed the foregoing instrument; and he acknowledged to me that he executed the same as and for the act and deed of said firm.

_____
Notary Public or Commissioner of Deeds

ACKNOWLEDGMENT OF PRINCIPAL, IF AN INDIVIDUAL

State of _____ County of _____ ss:

On this _____ day of _____, _____, before me personally appeared _____ to me known, and known to me to be the person described in and who executed the foregoing instrument; and acknowledged that he executed the same.

_____
Notary Public or Commissioner of Deeds

Each executed bond should be accompanied by: (a) appropriate acknowledgments of the respective parties; (b) appropriate duly certified copy of Power of Attorney or other certificate of authority where bond is executed by agent, officer or other representative of Principal or Surety; (c) a duly certified extract from By-Laws or resolutions of Surety under which Power of Attorney or other certificate of authority of its agent, officer or representative was issued, and (d) certified copy of latest published financial statement of assets and liabilities of Surety.

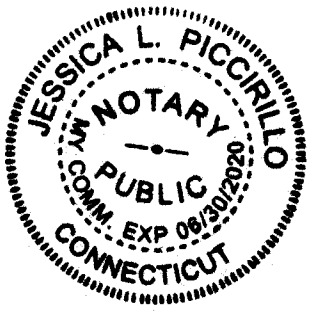
* * * * * * * *

Affix Acknowledgments and Justification of Sureties.

SURETY ACKNOWLEDGMENT

State of Connecticut
County of Hartford Ss.:

On this **6th** day of **August** in the year **2018,** before me personally come(s) **Victoria P. Parkerson** to me know, who, being by me duly sworn, deposes and says that same resides in **Farmington, CT** that same is the **Attorney-in-Fact** of the **Arch Insurance Company** the corporation described in and which executed the foregoing instrument; that same knows the seal of the said corporation; that the seal affixed to the said instrument is such corporate seal; that it was so affixed by the order of the Board of Directors of said corporation and that same signed the name thereto by like order.



Jessica L. Piccirillo
(Signature of Notary taking acknowledgment)

Jessica L. Piccirillo
My comm expires: 6/30/2020

AIC 0000236548

THIS POWER OF ATTORNEY IS NOT VALID UNLESS IT IS PRINTED ON BLUE BACKGROUND.

This Power of Attorney limits the acts of those named herein, and they have no authority to bind the Company except in the manner and to the extent herein stated. Not valid for Note, Loan, Letter of Credit, Currency Rate, Interest Rate or Residential Value Guarantees.

POWER OF ATTORNEY

Know All Persons By These Presents:

That the Arch Insurance Company, a corporation organized and existing under the laws of the State of Missouri, having its principal administrative office in Jersey City, New Jersey (hereinafter referred to as the "Company") does hereby appoint:

Diane Moraski, Hilda Muratori, Jessica Piccirillo, Kathleen M. Flanagan, Marion R. Vail, Richard A. Leveroni, Russell M. Canterbury and Victoria P. Parkerson of Farmington, CT (EACH)

its true and lawful Attorney(s)in-Fact, to make, execute, seal, and deliver from the date of issuance of this power for and on its behalf as surety, and as its act and deed:

Any and all bonds, undertakings, recognizances and other surety obligations, in the penal sum not exceeding
Ninety Million Dollars ($90,000,000.00).

This authority does not permit the same obligation to be split into two or more bonds in order to bring each such bond within the dollar limit of authority as set forth herein.

The execution of such bonds, undertakings, recognizances and other surety obligations in pursuance of these presents shall be as binding upon the said Company as fully and amply to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal administrative office in Jersey City, New Jersey.

This Power of Attorney is executed by authority of resolutions adopted by unanimous consent of the Board of Directors of the Company on September 15, 2011, true and accurate copies of which are hereinafter set forth and are hereby certified to by the undersigned Secretary as being in full force and effect:

"VOTED, That the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, or the Secretary shall have the power and authority to appoint agents and attorneys-in-fact, and to authorize them subject to the limitations set forth in their respective powers of attorney, to execute on behalf of the Company, and attach the seal of the Company thereto, bonds, undertakings, recognizances and other surety obligations obligatory in the nature thereof, and any such officers of the Company may appoint agents for acceptance of process."

This Power of Attorney is signed, sealed and certified by facsimile under and by authority of the following resolution adopted by the unanimous consent of the Board of Directors of the Company on September 15, 2011:

VOTED, That the signature of the Chairman of the Board, the President, or the Executive Vice President, or any Senior Vice President, of the Surety Business Division, or their appointees designated in writing and filed with the Secretary, and the signature of the Secretary, the seal of the Company, and certifications by the Secretary, may be affixed by facsimile on any power of attorney or bond executed pursuant to the resolution adopted by the Board of Directors on September 15, 2011, and any such power so executed, sealed and certified with respect to any bond or undertaking to which it is attached, shall continue to be valid and binding upon the Company.

In Testimony Whereof, the Company has caused this instrument to be signed and its corporate seal to be affixed by their authorized officers, this 30th day of January, 2018.

Attested and Certified

Arch Insurance Company

Patrick K. Nails, Secretary

David M. Finkelstein, Executive Vice President

STATE OF PENNSYLVANIA SS

COUNTY OF PHILADELPHIA SS

I, Michele Tripodi, a Notary Public, do hereby certify that Patrick K. Nails and David M. Finkelstein personally known to me to be the same persons whose names are respectively as Secretary and Executive Vice President of the Arch Insurance Company, a Corporation organized and existing under the laws of the State of Missouri, subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that they being thereunto duly authorized signed, sealed with the corporate seal and delivered the said instrument as the free and voluntary act of said corporation and as their own free and voluntary acts for the uses and purposes therein set forth.

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MICHELE TRIPODI, Notary Public
City of Philadelphia, Phila. County
My Commission Expires July 31, 2021

Michele Tripodi, Notary Public
My commission expires 07/31/2021

CERTIFICATION

I, Patrick K. Nails, Secretary of the Arch Insurance Company, do hereby certify that the attached Power of Attorney dated January 30, 2018 on behalf of the person(s) as listed above is a true and correct copy and that the same has been in full force and effect since the date thereof and is in full force and effect on the date of this certificate; and I do further certify that the said David M. Finkelstein, who executed the Power of Attorney as Executive Vice President, was on the date of execution of the attached Power of Attorney the duly elected Executive Vice President of the Arch Insurance Company.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seal of the Arch Insurance Company on this 6th day of August, 2018.

Patrick K. Nails, Secretary

This Power of Attorney limits the acts of those named therein to the bonds and undertakings specifically named therein and they have no authority to bind the Company except in the manner and to the extent herein stated.

PLEASE SEND ALL CLAIM INQUIRIES RELATING TO THIS BOND TO THE FOLLOWING ADDRESS:

Arch Insurance – Surety Division
3 Parkway, Suite 1500
Philadelphia, PA 19102

ARCH INSURANCE COMPANY
STATEMENT OF FINANCIAL CONDITION
DECEMBER 31, 2017

Assets

Cash in Banks	$ 141,654,914
Bonds owned	$ 2,483,719,500
Stocks	$ 446,692,985
Premiums in course of collection	$ 377,197,152
Accrued interest and other assets	$ 472,600,616
Total Assets	$ 3,921,865,167

Liabilities

Reserve for losses and adjustment expenses	$ 401,697,196
Reserve for unearned premiums	$ 363,948,898
Ceded reinsurance premiums payable	$ 1,449,246,831
Amounts withheld or retained by company for account of others	$ 214,539,977
Reserve for taxes, expenses and other liabilities	$ 562,652,882
Total Liabilities	2,992,085,784
Surplus as regards policyholders	929,779,383
Total Surplus and Liabilities	$ 3,921,865,167

By: _____ Attest: _____

Senior Vice President, Chief Financial Officer and Treasurer

Senior Vice President, General Counsel and Secretary

State of New Jersey)
) SS
County of Hudson)

Thomas James Ahern, Senior Vice President, Chief Financial Officer and Treasurer and Patrick Kenneth Nails, Senior Vice President, General Counsel and Secretary being duly sworn, of ARCH INSURANCE COMPANY, Missouri; and that the foregoing is a true and correct statement of financial condition of said company, as of December 31, 2017.

Subscribed and sworn to before me, this 5th day of March, 2018

Notary Public Mary E. Keating

MARY E. KEATING
NOTARY PUBLIC OF NEW JERSEY
ID # 2449626
My Commission Expires 8/28/2019

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 08/08/2018

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME: Larissa Velez	
AssuredPartners Northeast, LLC 100 Baylis Road Suite 300 Melville NY 11747	PHONE (A/C, No, Ext): (631)465-4000	FAX (A/C, No): (631)465-4005
	E-MAIL ADDRESS: larissa.velez@assuredpartners.com	

INSURED	INSURER(S) AFFORDING COVERAGE	NAIC #
C & L Contracting Corp. 1981 Marcus Avenue Suite E106 Lake Success NY 11042	INSURER A : Travelers Indemnity Co. of America	25666
	INSURER B : Charter Oak Fire Insurance Co	25615
	INSURER C : Travelers Property Casualty Company of America	25674
	INSURER D :	
	INSURER E :	
	INSURER F :	

COVERAGES **CERTIFICATE NUMBER:** 17-18 All Jobs **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	[X] COMMERCIAL GENERAL LIABILITY [ ] CLAIMS-MADE [X] OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC [ ] OTHER:			DT-CO-5G75688A-IND-1	12/31/2017	12/31/2018	EACH OCCURRENCE	$ 2,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 100,000
							MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 2,000,000
							GENERAL AGGREGATE	$ 4,000,000
							PRODUCTS - COMP/OP AGG	$ 4,000,000
								$
B	AUTOMOBILE LIABILITY [X] ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS [ ] HIRED AUTOS ONLY [ ] NON-OWNED AUTOS ONLY			DT-810-5G769708-COF-17	12/31/2017	12/31/2018	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
							BODILY INJURY (Per person)	$
							BODILY INJURY (Per accident)	$
							PROPERTY DAMAGE (Per accident)	$
							Underinsured motorist	$ 1,000,000
C	[ ] UMBRELLA LIAB [X] OCCUR [X] EXCESS LIAB [ ] CLAIMS-MADE [ ] DED [X] RETENTION $ 10,000			CUP-4K276244-17-26	12/31/2017	12/31/2018	EACH OCCURRENCE	$ 5,000,000
							AGGREGATE	$ 5,000,000
								$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y / N [ ] If yes, describe under DESCRIPTION OF OPERATIONS below	N / A					[ ] PER STATUTE [ ] OTH-ER	
							E.L. EACH ACCIDENT	$
							E.L. DISEASE - EA EMPLOYEE	$
							E.L. DISEASE - POLICY LIMIT	$

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

FMS ID: CRO-AGS, E-PIN: 85018B0040001, DDC PIN: 8502018CT0001C
Croton New Above Ground Structure and Landscaping, Borough of the Bronx.
City of New York, including its officials and employees are included as additional insured with respect to all policies listed above as per written contract.
30 day notice of cancellation applies, except for non payment which is 10 days.

CERTIFICATE HOLDER

New York City Department of Design and Construction
30-30 Thomson Avenue
Long Island City NY 11101

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

© 1988-2015 ACORD CORPORATION. All rights reserved.

The ACORD name and logo are registered marks of ACORD

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART III. Certification by Insurance Broker or Agent

The undersigned insurance broker or agent represents to the City of New York that the attached Certificate of Insurance is accurate in all material respects.

AssuredPartners Northeast LLC

[Name of broker or agent (typewritten)]

100 Baylis Road Suite 300, Melville NY 11747

[Address of broker or agent (typewritten)]

larissa.velez@assuredpartners.com

[Email address of broker or agent (typewritten)]

Phone: 631-844-5175

[Phone number/Fax number of broker or agent (typewritten)]

[Signature of authorized official or broker or agent]

Richard De La Sota - Executive Vice President

[Name and title of authorized official, broker or agent (typewritten)]

State of New York .....)
) ss:
County of Suffolk .....)

Sworn to before me this

8th day of August, 20 18

Kathryn C Hahl

NOTARY PUBLIC FOR THE STATE OF New York

KATHRYN C. HAHL
Notary Public, State of New York
No. 01HA6158067
Qualified in Nassau County
Commission Expires: Dec. 18, 20 18

NYSIF® **New York State Insurance Fund**

Workers' Compensation & Disability Benefits Specialists Since 1914

199 CHURCH STREET, NEW YORK, N.Y. 10007-1100

CERTIFICATE OF WORKERS' COMPENSATION INSURANCE

^^^^^^ 112790353
ASSUREDPARTNERS NORTHEAST LLC
100 BAYLIS RD STE 300
MELVILLE NY 11747

SCAN TO VALIDATE
AND SUBSCRIBE

POLICYHOLDER	CERTIFICATE HOLDER
C & L CONTRACTING CORP 1981 MARCUS AVENUE SUITE E 106 LAKE SUCCESS NY 11042	NEW YORK CITY DEPARTMENT OF DESIGN AND CONSTRUCTION 30-30 THOMSON AVE LONG ISLAND CITY NY 11101

POLICY NUMBER	CERTIFICATE NUMBER	POLICY PERIOD	DATE
Q2052 751-1	903968	01/01/2018 TO 01/01/2019	8/6/2018

THIS IS TO CERTIFY THAT THE POLICYHOLDER NAMED ABOVE IS INSURED WITH THE NEW YORK STATE INSURANCE FUND UNDER POLICY NO. 2052 751-1, COVERING THE ENTIRE OBLIGATION OF THIS POLICYHOLDER FOR WORKERS' COMPENSATION UNDER THE NEW YORK WORKERS' COMPENSATION LAW WITH RESPECT TO ALL OPERATIONS IN THE STATE OF NEW YORK, EXCEPT AS INDICATED BELOW, AND, WITH RESPECT TO OPERATIONS OUTSIDE OF NEW YORK, TO THE POLICYHOLDER'S REGULAR NEW YORK STATE EMPLOYEES ONLY.

IF YOU WISH TO RECEIVE NOTIFICATIONS REGARDING SAID POLICY, INCLUDING ANY NOTIFICATION OF CANCELLATIONS, OR TO VALIDATE THIS CERTIFICATE, VISIT OUR WEBSITE AT HTTPS://WWW.NYSIF.COM/CERT/CERTVAL.ASP. THE NEW YORK STATE INSURANCE FUND IS NOT LIABLE IN THE EVENT OF FAILURE TO GIVE SUCH NOTIFICATIONS.

THE POLICY INCLUDES A WAIVER OF SUBROGATION ENDORSEMENT UNDER WHICH NYSIF AGREES TO WAIVE ITS RIGHT OF SUBROGATION TO BRING AN ACTION AGAINST THE CERTIFICATE HOLDER TO RECOVER AMOUNTS WE PAID IN WORKERS' COMPENSATION AND/OR MEDICAL BENEFITS TO OR ON BEHALF OF AN EMPLOYEE OF OUR INSURED IN THE EVENT THAT, PRIOR TO THE DATE OF THE ACCIDENT, THE CERTIFICATE HOLDER HAS ENTERED INTO A WRITTEN CONTRACT WITH OUR INSURED THAT REQUIRES THAT SUCH RIGHT OF SUBROGATION BE WAIVED.

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS NOR INSURANCE COVERAGE UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICY.

NEW YORK STATE INSURANCE FUND

Sherwin Taylor

DIRECTOR,INSURANCE FUND UNDERWRITING

VALIDATION NUMBER: 716830312

U-26.3

NEW YORK STATE | Workers' Compensation Board

CERTIFICATE OF INSURANCE COVERAGE
DISABILITY AND PAID FAMILY LEAVE BENEFITS LAW

PART 1. To be completed by Disability and Paid Family Leave Benefits Carrier or Licensed Insurance Agent of that Carrier

1a. Legal Name & Address of Insured (use street address only)
C & L CONTRACTING CORP.
1981 MARCUS AVE, SUITE E106
LAKE SUCCESS, NY 11042

Work Location of Insured *(Only required if coverage is specifically limited to certain locations in New York State, i.e., Wrap-Up Policy)*

1b. Business Telephone Number of Insured
7188861958

1c. Federal Employer Identification Number of Insured or Social Security Number
11-2790353

2. Name and Address of Entity Requesting Proof of Coverage (Entity Being Listed as the Certificate Holder)
New York City Department of Design and Construction
30-30 Thomson Avenue
Long Island City , NY 11101

3a. Name of Insurance Carrier
Standard Security Life Insurance Company of New York

3b. Policy Number of Entity Listed in Box "1a"
L71567-000

3c. Policy effective period
1/1/2013 to 8/6/2019

4. Policy provides the following benefits:
- [x] A. Both disability and paid family leave benefits.
- [ ] B. Disability benefits only.
- [ ] C. Paid family leave benefits only.

5. Policy covers:
- [x] A. All of the employer's employees eligible under the NYS Disability and Paid Family Leave Benefits Law.
- [ ] B. Only the following class or classes of employer's employees:

Under penalty of perjury, I certify that I am an authorized representative or licensed agent of the insurance carrier referenced above and that the named insured has NYS Disability and/or Paid Family Leave Benefits insurance coverage as described above.

Date Signed 8/7/2018 By _____
(Signature of insurance carrier's authorized representative or NYS Licensed Insurance Agent of that insurance carrier)

Telephone Number (212) 355-4141 Name and Title SUPERVISOR-DBL/POLICY SERVICES

IMPORTANT: If Boxes 4A and 5A are checked, and this form is signed by the insurance carrier's authorized representative or NYS Licensed Insurance Agent of that carrier, this certificate is COMPLETE. Mail it directly to the certificate holder.

If Box 4B, 4C or 5B is checked, this certificate is NOT COMPLETE for purposes of Section 220, Subd. 8 of the NYS Disability and Paid Family Leave Benefits Law. It must be mailed for completion to the Workers' Compensation Board, Plans Acceptance Unit, PO Box 5200, Binghamton, NY 13902-5200.

PART 2. To be completed by the NYS Workers' Compensation Board (Only if Box 4C or 5B of Part 1 has been checked)

State of New York
Workers' Compensation Board

According to information maintained by the NYS Workers' Compensation Board, the above-named employer has complied with the NYS Disability and Paid Family Leave Benefits Law with respect to all of his/her employees.

Date Signed _____ By _____
(Signature of Authorized NYS Workers' Compensation Board Employee)

Telephone Number _____ Name and Title _____

Please Note: *Only insurance carriers licensed to write NYS disability and paid family leave benefits insurance policies and NYS licensed insurance agents of those insurance carriers are authorized to issue Form DB-120.1.* ***Insurance brokers are NOT authorized to issue this form.***

DB-120.1 (10-17)

Additional Instructions for Form DB-120.1

By signing this form, the insurance carrier identified in Box 3 on this form is certifying that it is insuring the business referenced in box "1a" for disability and/or paid family leave benefits under the New York State Disability and Paid Family Leave Benefits Law. The Insurance Carrier or its licensed agent will send this Certificate of Insurance to the entity listed as the certificate holder in Box 2.

The insurance carrier must notify the above certificate holder and the Workers' Compensation Board within 10 days IF a policy is cancelled due to nonpayment of premiums or within 30 days IF there are reasons other than nonpayment of premiums that cancel the policy or eliminate the insured from coverage indicated on this Certificate. (These notices my be sent by regular mail.) Otherwise, this Certificate is valid for one year after this form is approved by the insurance carrier or its licensed agent, or until the policy expiration date listed in Box 3c, whichever is earlier

This certificate is issued as a matter of information only and confers no rights upon the certificate holder. This certificate does not amend, extend or alter the coverage afforded by the policy listed, nor does it confer any rights or responsibilities beyond those contained in the referenced policy.

This certificate may be used as evidence of a Disability and/or Paid Family Leave Benefits contract of insurance only while the underlying policy is in effect.

Please Note: Upon the cancellation of the disability and/or paid family leave benefits policy indicated on this form, if the business continues to be named on a permit, license or contract issued by a certificate holder, the business must provide that certificate holder with a new Certificate of NYS Disability and/or Paid Family Leave Benefits Coverage or other authorized proof that the business is complying with the mandatory coverage requirements of the New York State Disability and Paid Family Leave Benefits Law.

DISABILITY AND PAID FAMILY LEAVE BENEFITS LAW

§220. Subd. 8

(a) The head of a state or municipal department, board, commission or office authorized or required by law to issue any permit for or in connection with any work involving the employment of employees in employment as defined in this article, and not withstanding any general or special statute requiring or authorizing the issue of such permits, shall not issue such permit unless proof duly subscribed by an insurance carrier is produced in a form satisfactory to the chair, that the payment of disability benefits and after January first, two thousand and twenty-one, the payment of family leave benefits for all employees has been secured as provided by this article. Nothing herein, however, shall be construed as creating any liability on the part of such state or municipal department, board, commission or office to pay any disability benefits to any such employee if so employed.

(b) The head of a state or municipal department, board, commission or office authorized or required by law to enter into any contract for or in connection with any work involving the employment of employees in employment as defined in this article and notwithstanding any general or special statute requiring or authorizing any such contract, shall not enter into any such contract unless proof duly subscribed by an insurance carrier is produced in a form satisfactory to the chair, that the payment of disability benefits and after January first, two thousand eighteen, the payment of family leave benefits for all employees has been secured as provided by this article.

OFFICE OF THE COMPTROLLER

CITY OF NEW YORK

220 APPRENTICESHIP PREVAILING WAGE SCHEDULE

APPENDIX

Pursuant to Labor Law §220 (3-e), only apprentices who are individually registered in a bona fide program to which the employer contractor is a participant and registered with the New York State Department of Labor, may be employed on a public work project.

Any employee listed on a payroll at an apprentice wage rate, who is not registered as above, shall be paid the journey person wage rate for the classification of work he actually performed.

Apprentice ratios are established to ensure the proper safety, training and supervision of apprentices. A ratio establishes the number of journey workers required for each apprentice in a program and on a job site. Ratios are interpreted as follows: in the case of a 1:1, 1:4 ratio, there must be one journey worker for the first apprentice, and four additional journey workers for each subsequent apprentice.

TABLE OF CONTENTS

CLASSIFICATION	PAGE
ASBESTOS HANDLER	3
BOILERMAKER	3
BRICKLAYER	4
CARPENTER	5
CARPENTER - HIGH RISE CONCRETE FORMS	6
CEMENT MASON	7
CEMENT AND CONCRETE WORKER	7
DERRICKPERSON & RIGGER (STONE)	8
DOCKBUILDER/PILE DRIVER	9
ELECTRICIAN	10
ELEVATOR CONSTRUCTOR	12
ELEVATOR REPAIR & MAINTENANCE	13
ENGINEER	14
ENGINEER - OPERATING	15
FLOOR COVERER	16
GLAZIER	16
HEAT & FROST INSULATOR	17
HOUSE WRECKER	18
IRON WORKER - ORNAMENTAL	18
IRON WORKER - STRUCTURAL	19
LABORER (FOUNDATION, CONCRETE, EXCAVATING, STREET PIPE LAYER & COMMON)	20
MARBLE MECHANICS	21
MASON TENDER	22
METALLIC LATHER	23
MILLWRIGHT	23
PAVER AND ROADBUILDER	24
PAINTER	24
PAINTER - METAL POLISHER	25
PAINTER - STRUCTURAL STEEL	26
PLASTERER	26
PLASTERER - TENDER	27
PLUMBER	28
POINTER, WATERPROOFER, CAULKER, SANDBLASTER, STEAMBLASTER	29
ROOFER	30
SHEET METAL WORKER	30
SIGN ERECTOR	32
STEAMFITTER	33
STONE MASON - SETTER	34
TAPER	35
TILE LAYER - SETTER	35
TIMBERPERSON	36

ASBESTOS HANDLER
(Ratio of Apprentice Journeyperson: 1 to 1, 1 to 3)

Asbestos Handler (First 1000 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 78% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $14.25

Asbestos Handler (Second 1000 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $14.25

Asbestos Handler (Third 1000 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 83% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $14.25

Asbestos Handler (Fourth 1000 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 89% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $14.25

(Local #78)

BOILERMAKER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Boilermaker (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $30.84
Effective 1/1/2018 - Supplemental Benefit Rate Per Hour: $31.26

Boilermaker (Second Year: 1st Six Months)

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $32.57
Effective 1/1/2018 - Supplemental Benefit Rate Per Hour: $33.02

Boilermaker (Second Year: 2nd Six Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $34.29
Effective 1/1/2018 - Supplemental Benefit Rate Per Hour: $34.78

Boilermaker (Third Year: 1st Six Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $36.03
Effective 1/1/2018- Supplemental Benefit Rate Per Hour: $36.56

Boilermaker (Third Year: 2nd Six Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 85% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $37.76
Effective 1/1/2018 - Supplemental Benefit Rate Per Hour: $38.32

Boilermaker (Fourth Year: 1st Six Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 90% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $39.51
Effective 1/1/2018 - Supplemental Benefit Rate Per Hour: $40.09

Boilermaker (Fourth Year: 2nd Six Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 95% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $41.22
Effective 1/1/2018- Supplemental Benefit Rate Per Hour: $41.84

(Local #5)

BRICKLAYER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Bricklayer (First 750 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $18.80

Bricklayer (Second 750 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $18.80

Bricklayer (Third 750 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $18.80

Bricklayer (Fourth 750 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $18.80

Bricklayer (Fifth 750 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 90% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $18.80

Bricklayer (Sixth 750 Hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 95% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $18.80

(Bricklayer District Council)

CARPENTER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Carpenter (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Benefit Rate Per Hour For Building Apprentice: $31.34

Supplemental Benefit Rate Per Hour For Heavy Apprentice: $33.03

Carpenter (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Benefit Rate Per Hour For Building Apprentice: $31.34
Supplemental Benefit Rate Per Hour For Heavy Apprentice: $33.03

Carpenter (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Benefit Rate Per Hour For Building Apprentice: $31.34
Supplemental Benefit Rate Per Hour For Heavy Apprentice: $33.03

Carpenter (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour For Building Apprentice: $31.34
Supplemental Benefit Rate Per Hour For Heavy Apprentice: $33.03

(Carpenters District Council)

CARPENTER - HIGH RISE CONCRETE FORMS
(Ratio of Apprentice to Journeyperson: 1 to 1, 2 to 5)

Carpenter - High Rise (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $16.86
Supplemental Benefit Rate per Hour: $16.20

Carpenter - High Rise (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $23.16
Supplemental Benefit Rate per Hour: $16.33

Carpenter - High Rise (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $29.61

Supplemental Benefit Rate per Hour: $16.46

Carpenter - High Rise (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $37.07
Supplemental Benefit Rate per Hour: $16.61

(Carpenters District Council)

CEMENT MASON
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Cement Mason (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 50% of Journeyperson's Rate

Cement Mason (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 60% of Journeyperson's Rate

Cement Mason (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 70% of Journeyperson's Rate

(Local #780)

CEMENT AND CONCRETE WORKER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Cement & Concrete Worker (First 1333 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $17.75

Cement & Concrete Worker (Second 1333 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $23.03

Cement & Concrete Worker (Last 1334 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $24.30

Cement & Concrete Worker (Hired after 2/6/2016 - First 1334 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: $16.96
Supplemental Benefit Rate Per Hour: $11.80

Cement & Concrete Worker (Hired after 2/6/2016 - Second 1334 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: $22.08
Supplemental Benefit Rate Per Hour: $16.49

Cement & Concrete Worker (Hired after 2/6/2016 - Last 1334 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: $27.20
Supplemental Benefit Rate Per Hour: $17.33

(Cement Concrete Workers District Council)

DERRICKPERSON & RIGGER (STONE)
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Derrickperson & Rigger (stone) - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: 50% of Journeyperson's rate

Derrickperson & Rigger (stone) - Second Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate

Supplemental Benefit Rate Per Hour: 75% of Journeyperson's rate

Derrickperson & Rigger (stone) - Second Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: 75% of Journeyperson's rate

Derrickperson & Rigger (stone) - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 90% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: 75% of Journeyperson's rate

(Local #197)

DOCKBUILDER/PILE DRIVER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 6)

Dockbuilder/Pile Driver (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $33.03

Dockbuilder/Pile Driver (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $33.03

Dockbuilder/Pile Driver (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $33.03

Dockbuilder/Pile Driver (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Benefit Rate Per Hour: $33.03

(Carpenters District Council)

ELECTRICIAN
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Electrician (First Term: 0-6 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $14.00
Supplemental Benefit Rate per Hour: $12.37
Overtime Supplemental Rate Per Hour: $13.29

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $14.50
Supplemental Benefit Rate per Hour: $12.63
Overtime Supplemental Rate Per Hour: $13.58

Electrician (First Term: 7-12 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $15.00
Supplemental Benefit Rate per Hour: $12.88
Overtime Supplemental Rate Per Hour: $13.87

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $15.50
Supplemental Benefit Rate per Hour: $13.14
Overtime Supplemental Rate Per Hour: $14.16

Electrician (Second Term: 0-6 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $16.00
Supplemental Benefit Rate per Hour: $13.39
Overtime Supplemental Rate Per Hour: $14.44

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $16.50
Supplemental Benefit Rate per Hour: $13.64
Overtime Supplemental Rate Per Hour: $14.73

Electrician (Second Term: 7-12 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $17.00
Supplemental Benefit Rate per Hour: $13.90

Overtime Supplemental Rate Per Hour: $15.02

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $17.50
Supplemental Benefit Rate per Hour: $14.15
Overtime Supplemental Rate Per Hour: $15.31

Electrician (Third Term: 0-6 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $18.00
Supplemental Benefit Rate per Hour: $14.41
Overtime Supplemental Rate Per Hour: $15.59

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $18.50
Supplemental Benefit Rate per Hour: $14.66
Overtime Supplemental Rate Per Hour: $15.88

Electrician (Third Term: 7-12 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $19.00
Supplemental Benefit Rate per Hour: $14.92
Overtime Supplemental Rate Per Hour: $16.17

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $19.50
Supplemental Benefit Rate per Hour: $15.17
Overtime Supplemental Rate Per Hour: $16.45

Electrician (Fourth Term: 0-6 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $20.00
Supplemental Benefit Rate per Hour: $15.43
Overtime Supplemental Rate Per Hour: $16.74

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $20.50
Supplemental Benefit Rate per Hour: $15.68
Overtime Supplemental Rate Per Hour: $17.03

Electrician (Fourth Term: 7-12 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $22.00
Supplemental Benefit Rate per Hour: $16.44
Overtime Supplemental Rate Per Hour: $17.89

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $22.50
Supplemental Benefit Rate per Hour: $16.70
Overtime Supplemental Rate Per Hour: $18.18

Electrician (Fifth Term: 0-12 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $24.00
Supplemental Benefit Rate per Hour: $19.80
Overtime Supplemental Rate Per Hour: $21.30

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $24.50
Supplemental Benefit Rate per Hour: $20.30
Overtime Supplemental Rate Per Hour: $21.84

Electrician (Fifth Term: 13-18 Months)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $28.50
Supplemental Benefit Rate per Hour: $22.10
Overtime Supplemental Rate Per Hour: $23.89

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $29.00
Supplemental Benefit Rate per Hour: $22.65
Overtime Supplemental Rate Per Hour: $24.47

Overtime Description
Overtime Wage paid at time and one half the regular rate

(Local #3)

ELEVATOR CONSTRUCTOR
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 2)

Elevator (Constructor) - First Year

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $29.88

Effective Period: 3/17/2018 - 6/30/2018

Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $31.35

Elevator (Constructor) - Second Year

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Rate Per Hour: $30.31

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Rate Per Hour: $31.80

Elevator (Constructor) - Third Year

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Rate Per Hour: $31.19

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Rate Per Hour: $32.70

Elevator (Constructor) - Fourth Year

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Rate Per Hour: $32.07

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Rate Per Hour: $33.60

(Local #1)

ELEVATOR REPAIR & MAINTENANCE
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 2)

Elevator Service/Modernization Mechanic (First Year)

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Benefit Per Hour: $29.80

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate

Supplemental Benefit Per Hour: $31.28

Elevator Service/Modernization Mechanic (Second Year)

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Benefit Per Hour: $30.23

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Benefit Per Hour: $31.72

Elevator Service/Modernization Mechanic (Third Year)

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Benefit Per Hour: $31.09

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Benefit Per Hour: $32.60

Elevator Service/Modernization Mechanic (Fourth Year)

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Benefit Per Hour: $31.95

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Benefit Per Hour: $33.49

(Local #1)

ENGINEER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 5)

Engineer - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $24.77
Supplemental Benefit Rate per Hour: $24.62

Engineer - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $30.97
Supplemental Benefit Rate per Hour: $24.62

Engineer - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $34.06
Supplemental Benefit Rate per Hour: $24.62

Engineer - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $37.16
Supplemental Benefit Rate per Hour: $24.62

(Local #15)

ENGINEER - OPERATING
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 5)

Operating Engineer - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour 40% of Journeyperson's Rate
Supplemental Benefit Per Hour: $20.85

Operating Engineer - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's Rate
Supplemental Benefit Per Hour: $20.85

Operating Engineer - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's Rate
Supplemental Benefit Per Hour: $20.85

(Local #14)

FLOOR COVERER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Floor Coverer (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Rate Per Hour: $31.14

Floor Coverer (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $31.14

Floor Coverer (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Rate Per Hour: $31.14

Floor Coverer (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: $31.14

(Carpenters District Council)

GLAZIER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Glazier (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Rate Per Hour: $15.26

Glazier (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate

Supplemental Rate Per Hour: $25.36

Glazier (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: $28.62

Glazier (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: $34.67

(Local #1281)

HEAT & FROST INSULATOR
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Heat & Frost Insulator (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 40% of Journeyperson's rate

Heat & Frost Insulator (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 60% of Journeyperson's rate

Heat & Frost Insulator (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 70% of Journeyperson's rate

Heat & Frost Insulator (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 80% of Journeyperson's rate

(Local #12)

HOUSE WRECKER
(TOTAL DEMOLITION)
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

House Wrecker - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $21.17
Supplemental Benefit Rate per Hour: $18.54

House Wrecker - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $22.32
Supplemental Benefit Rate per Hour: $18.54

House Wrecker - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $23.97
Supplemental Benefit Rate per Hour: $18.54

House Wrecker - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.53
Supplemental Benefit Rate per Hour: $18.54

(Mason Tenders District Council)

IRON WORKER - ORNAMENTAL
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Iron Worker (Ornamental) - 1st Ten Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $39.40

Iron Worker (Ornamental) - 11 -16 Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Rate Per Hour: $40.62

Iron Worker (Ornamental) - 17 - 22 Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: $41.83

Iron Worker (Ornamental) - 23 - 28 Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Rate Per Hour: $44.27

Iron Worker (Ornamental) - 29 - 36 Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: $46.70

(Local #580)

IRON WORKER - STRUCTURAL
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 6)

Iron Worker (Structural) - 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.12
Supplemental Benefit Rate per Hour: $50.22

Iron Worker (Structural) - 7- 18 Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.72
Supplemental Benefit Rate per Hour: $50.22

Iron Worker (Structural) - 19 - 36 months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $27.32

Supplemental Benefit Rate per Hour: $50.22

(Local #40 and #361)

LABORER (FOUNDATION, CONCRETE, EXCAVATING, STREET PIPE LAYER & COMMON)
(Ratio Apprentice to Journeyperson: 1 to 1, 1 to 3)

Laborer (Foundation, Concrete, Excavating, Street Pipe Layer & Common) - First 1000 hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $40.63

Laborer (Foundation, Concrete, Excavating, Street Pipe Layer & Common) - Second 1000 hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: $40.63

Laborer (Foundation, Concrete, Excavating, Street Pipe Layer & Common) - Third 1000 hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Rate Per Hour: $40.63

Laborer (Foundation, Concrete, Excavating, Street Pipe Layer & Common) - Fourth 1000 hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 90% of Journeyperson's rate
Supplemental Rate Per Hour: $40.63

(Local #731)

MARBLE MECHANICS
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Cutters & Setters - First 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 50% of Journeyperson's rate

NO BENEFITS PAID DURING THE FIRST TWO MONTHS (PROBATIONARY PERIOD)

Cutters & Setters - Second 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 55% of Journeyperson's rate

Cutters & Setters - Third 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 65% of Journeyperson's rate

Cutters & Setters - Fourth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 75% of Journeyperson's rate

Cutters & Setters - Fifth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 85% of Journeyperson's rate

Cutters & Setters - Sixth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 95% of Journeyperson's rate

Polishers & Finishers - First 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 50% of Journeyperson's rate

NO BENEFITS PAID DURING THE FIRST TWO MONTHS (PROBATIONARY PERIOD)

Polishers & Finishers - Second 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 60% of Journeyperson's rate

Polishers & Finishers - Third 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 75% of Journeyperson's rate

Polishers & Finishers - Fourth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 90% of Journeyperson's rate

(Local #7)

MASON TENDER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Mason Tender - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $21.39
Supplemental Benefit Rate per Hour: $19.65

Mason Tender - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $22.54
Supplemental Benefit Rate per Hour: $19.65

Mason Tender - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $24.29
Supplemental Benefit Rate per Hour: $19.70

Mason Tender - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.95
Supplemental Benefit Rate per Hour: $19.70

(Local #79)

METALLIC LATHER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Metallic Lather (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $28.38
Supplemental Benefit Rate per Hour: $10.96

Metallic Lather (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $32.38
Supplemental Benefit Rate per Hour: $12.96

Metallic Lather (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $35.38
Supplemental Benefit Rate per Hour: $17.12

Metallic Lather (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $37.38
Supplemental Benefit Rate per Hour: $17.92

(Local #46)

MILLWRIGHT
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Millwright (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $28.33
Supplemental Benefit Rate per Hour: $34.28

Millwright (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $33.48
Supplemental Benefit Rate per Hour: $37.88

Millwright (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $38.63
Supplemental Benefit Rate per Hour: $42.13

Millwright (Fourth Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $48.93
Supplemental Benefit Rate per Hour: $48.69

(Local #740)

PAVER AND ROADBUILDER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Paver and Roadbuilder - First Year (Minimum 1000 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $27.86
Supplemental Benefit Rate per Hour: $19.25

Paver and Roadbuilder - Second Year (Minimum 1000 hours)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $29.50
Supplemental Benefit Rate per Hour: $19.25

(Local #1010)

PAINTER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Painter - Brush & Roller - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $17.00
Supplemental Benefit Rate per Hour: $13.42

Painter - Brush & Roller - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $21.25
Supplemental Benefit Rate per Hour: $17.43

Painter - Brush & Roller - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $25.50
Supplemental Benefit Rate per Hour: $20.50

Painter - Brush & Roller - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $34.00
Supplemental Benefit Rate per Hour: $26.20

(District Council of Painters)

PAINTER - METAL POLISHER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Metal Polisher (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $11.75
Supplemental Benefit Rate per Hour: $5.13

Metal Polisher (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $13.00
Supplemental Benefit Rate per Hour: $5.13

Metal Polisher (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $15.75
Supplemental Benefit Rate per Hour: $5.13

(Local 8A-28)

PAINTER - STRUCTURAL STEEL
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Painters - Structural Steel (First Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 40% of Journeyperson's rate

Painters - Structural Steel (Second Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 60% of Journeyperson's rate

Painters - Structural Steel (Third Year)

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 80% of Journeyperson's rate

(Local #806)

PLASTERER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Plasterer - First Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Rate Per Hour: $13.59

Plasterer - First Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 45% of Journeyperson's rate
Supplemental Rate Per Hour: $14.07

Plasterer - Second Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Rate Per Hour: $16.04

Plasterer - Second Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: $17.12

Plasterer - Third Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Rate Per Hour: $19.29

Plasterer - Third Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Rate Per Hour: $20.37

(Local #530)

PLASTERER - TENDER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Plasterer Tender - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $21.39
Supplemental Benefit Rate per Hour: $19.65

Plasterer Tender - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $22.54

Supplemental Benefit Rate per Hour: $19.65

Plasterer Tender - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $24.29
Supplemental Benefit Rate per Hour: $19.70

Plasterer Tender - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.95
Supplemental Benefit Rate per Hour: $19.70

(Local #79)

PLUMBER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Plumber - First Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $16.28
Supplemental Benefit Rate per Hour: $5.43

Plumber - First Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $19.28
Supplemental Benefit Rate per Hour: $6.43

Plumber - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.35
Supplemental Benefit Rate per Hour: $17.10

Plumber - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $28.45
Supplemental Benefit Rate per Hour: $17.10

Plumber - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $31.30
Supplemental Benefit Rate per Hour: $17.10

Plumber - Fifth Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $32.70
Supplemental Benefit Rate per Hour: $17.10

Plumber - Fifth Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $44.77
Supplemental Benefit Rate per Hour: $17.10

(Plumbers Local #1)

POINTER, WATERPROOFER, CAULKER, SANDBLASTER, STEAMBLASTER
(Exterior Building Renovation)
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Pointer, Waterproofer, Caulker, Sandblaster, Steamblaster - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $25.89
Supplemental Benefit Rate per Hour: $13.64

Pointer, Waterproofer, Caulker, Sandblaster, Steamblaster - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $28.97
Supplemental Benefit Rate per Hour: $18.15

Pointer, Waterproofer, Caulker, Sandblaster, Steamblaster - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $34.12
Supplemental Benefit Rate per Hour: $20.90

Pointer, Waterproofer, Caulker, Sandblaster, Steamblaster - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.33
Supplemental Benefit Rate per Hour: $21.60

(Bricklayer District Council)

ROOFER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 2)

Roofer - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 35% of Journeyperson's Rate

Roofer - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 50% of Journeyperson's Rate

Roofer - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 60% of Journeyperson's Rate

Roofer - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 75% of Journeyperson's Rate

(Local #8)

SHEET METAL WORKER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Sheet Metal Worker (0-6 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 25% of Journeyperson's rate
Supplemental Rate Per Hour: $6.35

Sheet Metal Worker (7-18 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 35% of Journeyperson's rate
Supplemental Rate Per Hour: $17.12

Sheet Metal Worker (19-30 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 45% of Journeyperson's rate
Supplemental Rate Per Hour: $23.54

Sheet Metal Worker (31-36 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Rate Per Hour: $27.70

Sheet Metal Worker (37-42 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: $29.11

Sheet Metal Worker (43-48 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Rate Per Hour: $33.96

Sheet Metal Worker (49-54 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Rate Per Hour: $36.07

Sheet Metal Worker (55-60 Months)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: $38.15

(Local #28)

SIGN ERECTOR
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Sign Erector - First Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 35% of Journeyperson's rate
Supplemental Rate Per Hour: $14.72

Sign Erector - First Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Rate Per Hour: $16.71

Sign Erector - Second Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 45% of Journeyperson's rate
Supplemental Rate Per Hour: $18.68

Sign Erector - Second Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $20.68

Sign Erector - Third Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 55% of Journeyperson's rate
Supplemental Rate Per Hour: $27.72

Sign Erector - Third Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: $30.57

Sign Erector - Fourth Year: 1st Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Rate Per Hour: $33.31

Sign Erector - Fourth Year: 2nd Six Months

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Rate Per Hour: $35.83

Sign Erector - Fifth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 75% of Journeyperson's rate
Supplemental Rate Per Hour: $38.32

Sign Erector - Sixth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: $40.81

(Local #137)

STEAMFITTER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 3)

Steamfitter - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate and Supplemental Per Hour: 40% of Journeyperson's rate

Steamfitter - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate and Supplemental Rate Per Hour: 50% of Journeyperson's rate.

Steamfitter - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate and Supplemental Rate per Hour: 65% of Journeyperson's rate.

Steamfitter - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate and Supplemental Rate Per Hour: 80% of Journeyperson's rate.

Steamfitter - Fifth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate and Supplemental Rate Per Hour: 85% of Journeyperson's rate.

(Local #638)

STONE MASON - SETTER
(Ratio Apprentice of Journeyperson: 1 to 1, 1 to 2)

Stone Mason - Setters - First 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 50% of Journeyperson's rate

Stone Mason - Setters - Second 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 60% of Journeyperson's rate
Supplemental Rate Per Hour: 50% of Journeyperson's rate

Stone Mason - Setters - Third 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 70% of Journeyperson's rate
Supplemental Rate Per Hour: 50% of Journeyperson's rate

Stone Mason - Setters - Fourth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: 50% of Journeyperson's rate

Stone Mason - Setters - Fifth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 90% of Journeyperson's rate
Supplemental Rate Per Hour: 50% of Journeyperson's rate

Stone Mason - Setters - Sixth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 100% of Journeyperson's rate
Supplemental Rate Per Hour: 50% of Journeyperson's rate

(Bricklayers District Council)

TAPER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Drywall Taper - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 40% of Journeyperson's rate

Drywall Taper - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 60% of Journeyperson's rate

Drywall Taper - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 80% of Journeyperson's rate

(Local #1974)

TILE LAYER - SETTER
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 4)

Tile Layer - Setter - First 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 50% of Journeyperson's rate

Tile Layer - Setter - Second 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 55% of Journeyperson's rate

Tile Layer - Setter - Third 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 65% of Journeyperson's rate

Tile Layer - Setter - Fourth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 75% of Journeyperson's rate

Tile Layer - Setter - Fifth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 85% of Journeyperson's rate

Tile Layer - Setter - Sixth 750 Hours

Effective Period: 7/1/2017 - 6/30/2018
Wage and Supplemental Rate Per Hour: 95% of Journeyperson's rate

(Local #7)

TIMBERPERSON
(Ratio of Apprentice to Journeyperson: 1 to 1, 1 to 6)

Timberperson - First Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 40% of Journeyperson's rate
Supplemental Rate Per Hour: $32.79

Timberperson - Second Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 50% of Journeyperson's rate
Supplemental Rate Per Hour: $32.79

Timberperson - Third Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 65% of Journeyperson's rate
Supplemental Rate Per Hour: $32.79

Timberperson - Fourth Year

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate Per Hour: 80% of Journeyperson's rate
Supplemental Rate Per Hour: $32.79

(Local #1536)

LABOR LAW §220 PREVAILING WAGE SCHEDULE

Workers, Laborers and Mechanics employed on a public work project must receive not less than the prevailing rate of wage and benefits for the classification of work performed by each upon such public work. Pursuant to Labor Law §220 the Comptroller of the City of New York has promulgated this schedule solely for Workers, Laborers and Mechanics engaged by private contractors on New York City public work contracts.

This schedule is a compilation of separate determinations of the prevailing rate of wage and supplements made by the Comptroller for each trade classification listed herein pursuant to New York State Labor Law section 220 (5). The source of the wage and supplement rates, whether a collective bargaining agreement, survey data or other, is listed at the end of each classification.

Agency Chief Contracting Officers should contact the Bureau of Labor Law's Classification Unit with any questions concerning trade classifications, prevailing rates or prevailing practices with respect to procurement on New York City public works contracts. Contractors are advised to review the Comptroller's Prevailing Wage Schedule before bidding on public works contracts. Contractors with questions concerning trade classifications, prevailing rates or prevailing practices with respect to public works contracts in the procurement stage must contact the contracting agency responsible for the procurement.

Any error as to compensation under the prevailing wage law or other information as to trade classification, made by the contracting agency in the contract documents or in any other communication, will not preclude a finding against the contractor of prevailing wage violation.

Any questions concerning trade classifications, prevailing rates or prevailing practices on New York City public works contracts that have already been awarded may be directed to the Bureau of Labor Law's Classification Unit by calling (212) 669-4443. All callers must have the agency name and contract registration number available when calling with questions on public works contracts. Please direct all other compliance issues to: Bureau of Labor Law, Attn: Wasyl Kinach, P.E., Office of the Comptroller, 1 Centre Street, Room 651, New York, N.Y. 10007; Fax (212) 669-4002.

The appropriate schedule of prevailing wages and benefits must be posted at all public work sites pursuant to Labor Law §220 (3-a) (a).

This schedule is applicable to work performed during the effective period, unless otherwise noted. Changes to this schedule are published on our web site www.comptroller.nyc.gov. Contractors must pay the wages and supplements in effect when the worker, laborer, mechanic performs the work. Preliminary schedules for future one-year periods appear in the City Record on or about June 1 each succeeding year. Final schedules appear on or about July 1 in the City Record and on our web site www.comptroller.nyc.gov.

The Comptroller's Office has attempted to include all overtime, shift and night differential, Holiday, Saturday, Sunday or other premium time work. However, this schedule does not set forth every prevailing practice with respect to such rates with which employers must comply. All such practices are nevertheless part of the employer's prevailing wage obligation and contained in the collective bargaining agreements of the prevailing wage unions. These collective bargaining agreements are available for inspection by appointment. Requests for appointments may be made by calling (212) 669-4443, Monday through Friday between the hours of 9 a.m. and 5 p.m.

Prevailing rates and ratios for apprentices are attached to this schedule in the Appendix. Pursuant to Labor Law §220 (3-e), only apprentices who are individually registered in a bona fide program to which the employer contractor is a participant, registered with the New York State Department of Labor, may be employed on a public work project. Workers who are not journey persons or not registered apprentices pursuant to Labor Law §220 (3-e) may not be substituted for apprentices and must be paid as journey persons.

Public Work construction, reconstruction, demolition, excavation, rehabilitation, repair, renovation, alteration, or improvement contracts awarded pursuant to a Project Labor Agreement ("PLA") in accordance with Labor Law section 222 may have different labor standards for shift, premium and overtime work. Please refer to the PLA's pre-negotiated labor agreements for wage and benefit rates applicable to work performed outside of the regular workday. More information is available at the Mayor's Office of Contract Services (MOCS) web page at http://www.nyc.gov/html/mocs/html/vendors/pla.shtml.

All the provisions of Labor Law section 220 remain applicable to PLA work including, but not limited to, the enforcement of prevailing wage requirements by the Comptroller; however, we will enforce shift, premium, overtime and other non-standard rates as they appear in a project's pre-negotiated labor agreement.

In order to meet their obligation to provide prevailing supplemental benefits to each covered employee, employers must either:

1) Provide bona fide fringe benefits which cost the employer no less than the prevailing supplemental benefits rate; or
2) Supplement the employee's hourly wage by an amount no less than the prevailing supplemental benefits rate; or
3) Provide a combination of bona fide fringe benefits and wage supplements which cost the employer no less than the prevailing supplemental benefits rate in total.

Although prevailing wage laws do not require employers to provide bona fide fringe benefits (as opposed to wage supplements) to their employees, other laws may. For example, the Employee Retirement Income Security Act, 29 U.S.C. § 1001 et seq., the Patient Protection and Affordable Care Act, 42 U.S.C. § 18001 et seq., and the New York City Paid Sick Leave Law, N.Y.C. Admin. Code § 20-911 et seq., require certain employers to provide certain benefits to their employees. Labor agreements to which employers are a party may also require certain benefits. The Comptroller's Office does not enforce these laws or agreements.

Employers must provide prevailing supplemental benefits at the straight time rate for <u>each hour worked</u> unless otherwise noted in the classification.

Wasyl Kinach, P.E.
Director of Classifications
Bureau of Labor Law

TABLE OF CONTENTS

CLASSIFICATION	PAGE
ASBESTOS HANDLER	5
BLASTER	5
BOILERMAKER	7
BRICKLAYER	8
CARPENTER - BUILDING COMMERCIAL	9
CARPENTER - HEAVY CONSTRUCTION WORK	10
CARPENTER - HIGH RISE CONCRETE FORMS	11
CARPENTER - SIDEWALK SHED, SCAFFOLD AND HOIST	12
CEMENT & CONCRETE WORKER	13
CEMENT MASON	14
CORE DRILLER	15
DERRICKPERSON AND RIGGER	16
DIVER	17
DOCKBUILDER - PILE DRIVER	18
DRIVER: TRUCK (TEAMSTER)	19
ELECTRICIAN	21
ELECTRICIAN - ALARM TECHNICIAN	24
ELECTRICIAN-STREET LIGHTING WORKER	25
ELEVATOR CONSTRUCTOR	26
ELEVATOR REPAIR & MAINTENANCE	27
ENGINEER	28
ENGINEER - CITY SURVEYOR AND CONSULTANT	33
ENGINEER - FIELD (BUILDING CONSTRUCTION)	34
ENGINEER - FIELD (HEAVY CONSTRUCTION)	35
ENGINEER - FIELD (STEEL ERECTION)	36
ENGINEER - OPERATING	37
FLOOR COVERER	45
GLAZIER	46
GLAZIER - REPAIR & MAINTENANCE	47
HEAT AND FROST INSULATOR	48
HOUSE WRECKER	49
IRON WORKER - ORNAMENTAL	49
IRON WORKER - STRUCTURAL	50
LABORER	51
LANDSCAPING	52

MARBLE MECHANIC 54
MASON TENDER 55
MASON TENDER (INTERIOR DEMOLITION WORKER) 56
METALLIC LATHER 56
MILLWRIGHT 57
MOSAIC MECHANIC 58
PAINTER 59
PAINTER - METAL POLISHER 60
PAINTER - STRIPER 61
PAINTER - STRUCTURAL STEEL 62
PAPERHANGER 63
PAVER AND ROADBUILDER 64
PLASTERER 66
PLASTERER - TENDER 67
PLUMBER 67
PLUMBER (MECHNICAL EQUIPMENT AND SERVICE) 68
PLUMBER (RESIDENTIAL RATES FOR 1, 2 AND 3 FAMILY HOME CONSTRUCTION) 69
PLUMBER: PUMP & TANK 70
POINTER, WATERPROOFER, CAULKER, SANDBLASTER, STEAMBLASTER 71
ROOFER 72
SHEET METAL WORKER 72
SHEET METAL WORKER - SPECIALTY 73
SHIPYARD WORKER 74
SIGN ERECTOR 76
STEAMFITTER 76
STEAMFITTER - REFRIGERATION AND AIR CONDITIONER 78
STONE MASON - SETTER 80
TAPER 81
TELECOMMUNICATION WORKER 82
TILE FINISHER 83
TILE LAYER - SETTER 84
TIMBERPERSON 84
TUNNEL WORKER 85
WELDER 87

ASBESTOS HANDLER
(Hazardous Material; Disturbs, removes, encapsulates, repairs, or encloses friable asbestos material)

Asbestos Handler

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $36.00
Supplemental Benefit Rate per Hour: $16.45

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Sunday.
Time and one half the regular hourly rate after 40 hours in any work week.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day
Easter

Paid Holidays
None

(Local #78 and Local #12A)

BLASTER

Blaster

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.27
Supplemental Benefit Rate per Hour: $47.99

Blaster (Hydraulic)

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate per Hour: $47.15
Supplemental Benefit Rate per Hour: $47.99

Blaster - Trac Drill Hydraulic

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.29
Supplemental Benefit Rate per Hour: $47.99

Blaster - Wagon: Air Trac: Quarry Bar: Drillrunners

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $40.46
Supplemental Benefit Rate per Hour: $47.99

Blaster - Operators of Jack Hammers

Chippers: Spaders: Concrete Breakers: and all other pneumatic tools of like usage: Walk Behind Self Propelled Hydraulic Asphalt and Concrete Breakers: Hydro (Water) Demolition

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $39.34
Supplemental Benefit Rate per Hour: $47.99

Blaster - Powder Carriers

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $35.17
Supplemental Benefit Rate per Hour: $47.99

Blaster - Hydraulic Trac Drill Chuck Tender

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $33.81
Supplemental Benefit Rate per Hour: $47.99

Blaster - Chuck Tender & Nipper

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $33.00
Supplemental Benefit Rate per Hour: $47.99

Blaster - Magazine Keepers: (Watch Person)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $18.22
Supplemental Benefit Rate per Hour: $47.99

Overtime Description

Magazine Keepers:
Time and one half for work performed in excess of forty (40) hours per week and for work performed on Saturdays, Sundays and Holidays.

All Other Employees:
Time and one-half for the first two hours of overtime Monday through Friday, the first ten hours, the first ten hours of work on Saturday and for Make-up Time. Double time for all hours over ten Monday through Saturday (except make-up hours) and for all hours worked on Sunday and Holidays.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day
Christmas Day

Paid Holidays

None

Shift Rates

A single shift shall be 8 hours plus an unpaid lunch, starting at 8:00 A.M (or between 6:00 A.M. and 10:00 A.M. on weekdays). When two (2) shifts are employed, each shift shall be 8 hours plus ½ hour unpaid lunch. When three (3) shifts are employed, each shift will work seven and one-half (7 ½) hours, but will be paid for eight (8) hours, since only one-half (½) hour is allowed for mealtime. When two (2) or more shifts are employed, single time will be paid for each shift. The first 8 hours of any and all work performed Monday through Friday inclusive of any off-shift shall be at the single time rate.

(Local #29)

BOILERMAKER

Boilermaker

Effective Period: 7/1/2017 - 12/31/2017
Wage Rate per Hour: $55.23
Supplemental Benefit Rate per Hour: $42.96
Supplemental Note: For time and one half overtime - $63.82 For double overtime - $84.68

Effective Period: 1/1/2018 - 6/30/2018
Wage Rate per Hour: $57.17
Supplemental Benefit Rate per Hour: $43.62
Supplemental Note: For time and one half overtime - $64.81 For double overtime - $86.00

Overtime Description

For Repair and Maintenance work:
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
For New Construction work:
Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Columbus Day
Election Day
Veteran's Day
Thanksgiving Day
Christmas Day

Quadruple time the regular rate for work on the following holiday(s).
Labor Day

Paid Holidays

Good Friday
Day after Thanksgiving
Day before Christmas
Day before New Year's Day

Shift Rates

When shifts are required, the first shift shall work eight (8) hours at the regular straight-time hourly rate. The second shift shall work seven and one-half (7 ½) hours and receive eight hours at the regular straight time hourly rate plus twenty-five cents ($0.25) per hour. The third shift shall work seven (7) hours and receive eight hours at the regular straight time hourly rate plus fifty cents ($0.50) per hour. A thirty (30) minute lunch period shall not be considered as time worked. Work in excess of the above shall be paid overtime at the appropriate new construction work or repair work overtime wage and supplemental benefit hourly rate.

(Local #5)

BRICKLAYER

Bricklayer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $55.10

Supplemental Benefit Rate per Hour: $31.20

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
Overtime rates to be paid outside the regular scheduled work day.

(Bricklayer District Council)

CARPENTER - BUILDING COMMERCIAL

Building Commercial

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $52.50
Supplemental Benefit Rate per Hour: $46.28

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Washington's Birthday

Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
The second shift will receive one hour at the double time rate of pay for the last hour of the shift; eight hours pay for seven hours of work, nine hours pay for eight hours of work. There must be a first shift in order to work a second shift.

(Carpenters District Council)

CARPENTER - HEAVY CONSTRUCTION WORK
(Construction of Engineering Structures and Building Foundations)

Heavy Construction Work

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $52.63
Supplemental Benefit Rate per Hour: $49.66

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
Off shift work commencing between 5:00 P.M. and 11:00 P.M. shall work eight and one half hours allowing for one half hour for lunch. The wage rate shall be 113% of the straight time hourly wage rate.

(Carpenters District Council)

CARPENTER - HIGH RISE CONCRETE FORMS
(Excludes Engineering Structures and Building Foundations)

Carpenter High Rise A

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $50.78
Supplemental Benefit Rate per Hour: $41.49

Carpenter High Rise B

Carpenter High Rise B worker is excluded from high risk operations such as erection decking, perimeter debris netting, leading edge work, self-climbing form systems, and the installation of cocoon systems unless directly supervised by a Carpenter High Rise A worker.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $39.07
Supplemental Benefit Rate per Hour: $16.65

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day

Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
The second shift wage rate shall be 113% of the straight time hourly wage rate. There must be a first shift in order to work a second shift.

(Carpenters District Council)

CARPENTER - SIDEWALK SHED, SCAFFOLD AND HOIST

Carpenter - Hod Hoist

(Assisted by Mason Tender)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $50.50
Supplemental Benefit Rate per Hour: $39.46

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
The second shift will receive one hour at the double time rate of pay for the last hour of the shift; eight hours pay for seven hours of work, nine hours pay for eight hours of work. There must be a first shift in order to work a second shift.

(Carpenters District Council)

CEMENT & CONCRETE WORKER

Cement & Concrete Worker

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.48
Supplemental Benefit Rate per Hour: $26.00
Supplemental Note: $29.50 on Saturdays; $33.00 on Sundays & Holidays

Cement & Concrete Worker - (Hired after 2/6/2016)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $32.00
Supplemental Benefit Rate per Hour: $18.00
Supplemental Note: $19.50 on Saturdays; $21.00 on Sundays & Holidays

Overtime Description
Time and one half the regular rate after 7 hour day (time and one half the regular rate after an 8 hour day when working with Dockbuilders on pile cap forms and for work below street level to the top of the foundation wall, not to exceed 2 feet or 3 feet above the sidewalk-brick shelf, when working on the foundation and structure.)

Overtime
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays

1/2 day before Christmas Day
1/2 day before New Year's Day

Shift Rates
On shift work extending over a twenty-four hour period, all shifts are paid at straight time.

(Cement Concrete Workers District Council)

CEMENT MASON

Cement Mason

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.62
Supplemental Benefit Rate per Hour: $38.96
Supplemental Note: For time and one half overtime - $48.21; For double overtime - $57.46

Overtime Description
Time and one-half the regular rate after an 8 hour day, double time the regular rate after 10 hours. Time and one-half the regular rate on Saturday, double time the regular rate after 10 hours. Double time the regular rate on Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays
Any worker who reports to work on Christmas Eve or New Year's Eve pursuant to his employer's instruction shall be entitled to three (3) hours afternoon pay without working.

Shift Rates
For an off shift day, (work at times other than the regular 7:00 A.M. to 3:30 P.M. work day) a cement mason shall be paid at the regular hourly rate plus a 25% per hour differential. Four Days a week at Ten (10)hour day.

(Local #780) (BCA)

CORE DRILLER

Core Driller

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $38.82
Supplemental Benefit Rate per Hour: $24.66

Core Driller Helper

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $30.96
Supplemental Benefit Rate per Hour: $24.66

Core Driller Helper(Third year in the industry)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $27.86
Supplemental Benefit Rate per Hour: $24.66

Core Driller Helper (Second year in the industry)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $24.77
Supplemental Benefit Rate per Hour: $24.66

Core Driller Helper (First year in the industry)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $21.67
Supplemental Benefit Rate per Hour: $24.66

Overtime Description

Time and one half the regular rate for work on a holiday plus Holiday pay when worked.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Time and one half the regular rate for work on the following holiday(s).

Paid Holidays

New Year's Day
Memorial Day
Independence Day

Labor Day
Thanksgiving Day
Christmas Day

Shift Rates

The shift day shall be the continuous eight and one-half (8½) hours from 6:00 A.M. to 2:30 P.M. and from 2:30 P.M. to 11:00 P.M., including one-half (½) hour of employees regular rate of pay for lunch. When two (2) or more shifts are employed, single time shall be paid for each shift, but those employees employed on a shift other than from 8:00 A.M. to 5:00 P.M. shall, in addition, receive seventy-five cents ($0.75) per hour differential for each hour worked. When three (3) shifts are needed, each shift shall work seven and one-half (7 ½) hours paid for eight (8) hours of labor and be permitted one-half (½) hour for mealtime.

(Carpenters District Council)

DERRICKPERSON AND RIGGER

Derrick Person & Rigger

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.86
Supplemental Benefit Rate per Hour: $51.40
Supplemental Note: The above supplemental rate applies for work performed in Manhattan, Bronx, Brooklyn and Queens. $52.82 - For work performed in Staten Island.

Derrick Person & Rigger - Site Work

Assists the Stone Mason-Setter in the setting of stone

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $40.29
Supplemental Benefit Rate per Hour: $39.23

Overtime Description

The first two hours of overtime on weekdays and the first seven hours of work on Saturdays are paid at time and one half for wages and supplemental benefits. All additional overtimes is paid at double time for wages and supplemental benefits. Deduct $1.42 from the Staten Island hourly benefits rate before computing overtime.

Overtime

Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
Washington's Birthday
Good Friday
Memorial Day

Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
1/2 day on Christmas Eve if work is performed in the A.M.

(Local #197)

DIVER

Diver (Marine)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $66.66
Supplemental Benefit Rate per Hour: $49.66

Diver Tender (Marine)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.34
Supplemental Benefit Rate per Hour: $49.66

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates

When three shifts are utilized each shift shall work seven and one half-hours (7 1/2 hours) and paid for 8 hours, allowing for one half hour for lunch.

(Carpenters District Council)

DOCKBUILDER - PILE DRIVER

Dockbuilder - Pile Driver

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $52.63
Supplemental Benefit Rate per Hour: $49.66

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays

None

Shift Rates

Off shift work commencing between 5:00 P.M. and 11:00 P.M. shall work eight and one half hours allowing for one half hour for lunch. The wage rate shall be 113% of the straight time hourly wage rate.

(Carpenters District Council)

DRIVER: TRUCK (TEAMSTER)

Driver - Dump Truck

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.18
Supplemental Benefit Rate per Hour: $44.79
Supplemental Note: Over 40 hours worked: at time and one half rate - $19.94; at double time rate - $26.58

Driver - Tractor Trailer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.22
Supplemental Benefit Rate per Hour: $45.40
Supplemental Note: Over 40 hours worked: at time and one half rate - $17.55; at double time rate - $23.40

Driver - Euclid & Turnapull Operator

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.78
Supplemental Benefit Rate per Hour: $45.40
Supplemental Note: Over 40 hours worked: at time and one half rate - $17.55 at double time rate - $23.40

Overtime Description

For Paid Holidays: Holiday pay for all holidays shall be prorated based two hours per day for each day worked in the holiday week, not to exceed 8 hours of holiday pay. For Thanksgiving week, the prorated share shall be 5 1/3 hours of holiday pay for each day worked in Thanksgiving week.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays

New Year's Day
President's Day
Memorial Day

Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates

Off single shift work commencing between 6:00 P.M. and 5:00 A.M. shall work eight and one half hours allowing for one half hour for lunch and receive 9 hours pay for 8 hours of work.

Driver Redi-Mix (Sand & Gravel)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $38.40
Supplemental Benefit Rate per Hour: $42.12
Supplemental Note: Over 40 hours worked: time and one half rate $15.99, double time rate $21.33

Overtime Description

For Paid Holidays: Employees working two (2) days in the calendar week in which the holiday falls are to paid for these holidays, provided they shape each remaining workday during that calendar week.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
President's Day
Columbus Day
Veteran's Day

Triple time the regular rate for work on the following holiday(s).
New Year's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays

New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day

Election Day
Thanksgiving Day
Christmas Day

(Local #282)

ELECTRICIAN

(Including all low voltage cabling carrying data; video; and voice in combination with data and or video.)

Electrician "A" (Regular Day / Day Shift)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $56.00
Supplemental Benefit Rate per Hour: $54.35

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $56.00
Supplemental Benefit Rate per Hour: $55.72

Electrician "A" (Regular Day Overtime after 7 hrs / Day Shift Overtime after 8 hrs)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $84.00
Supplemental Benefit Rate per Hour: $57.86

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $84.00
Supplemental Benefit Rate per Hour: $59.23

Electrician "A" (Swing Shift)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $65.71
Supplemental Benefit Rate per Hour: $61.94

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $65.71
Supplemental Benefit Rate per Hour: $63.52

Electrician "A" (Swing Shift Overtime After 7.5 hours)

Effective Period: 7/1/2017 - 5/9/2018

Wage Rate per Hour: $98.57
Supplemental Benefit Rate per Hour: $66.05

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $98.57
Supplemental Benefit Rate per Hour: $67.64

Electrician "A" (Graveyard Shift)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $73.60
Supplemental Benefit Rate per Hour: $68.33

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $73.60
Supplemental Benefit Rate per Hour: $70.09

Electrician "A" (Graveyard Shift Overtime After 7 hours)

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $110.40
Supplemental Benefit Rate per Hour: $72.95

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $110.40
Supplemental Benefit Rate per Hour: $74.70

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on a holiday.
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates

When so elected by the Employer, one or more shifts of at least five days duration may be scheduled as follows: Day Shift: 8:00 am to 4:30 pm, Swing Shift 4:30 pm to 12:30 am, Graveyard Shift: 12:30 am to 8:00 am.

For multiple shifts of temporary light and/or power, the temporary light and/or power employee shall be paid for 8 hours at the straight time rate. For three or less workers performing 8 hours temporary light and/or power the supplemental benefit rate is $25.67 and effective 5/10/18 $25.92.

Electrician "M" (First 8 hours)

"M" rated work shall be defined as jobbing: electrical work of limited duration and scope, also consisting of repairs and/or replacement of electrical and tele-data equipment. Includes all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls and washing and cleaning of foregoing fixtures.

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $28.50
Supplemental Benefit Rate per Hour: $22.10
First and Second Year "M" Wage Rate Per Hour: $24.00
First and Second Year "M" Supplemental Rate: $19.80

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $29.00
Supplemental Benefit Rate per Hour: $22.65
First and Second Year "M" Wage Rate Per Hour: $24.50
First and Second Year "M" Supplemental Rate: $20.30

Electrician "M" (Overtime After First 8 hours)

"M" rated work shall be defined as jobbing: electrical work of limited duration and scope, also consisting of repairs and/or replacement of electrical and tele-data equipment. Includes all work necessary to retrofit, service, maintain and repair all kinds of lighting fixtures and local lighting controls and washing and cleaning of foregoing fixtures.

Effective Period: 7/1/2017 - 5/9/2018
Wage Rate per Hour: $42.75
Supplemental Benefit Rate per Hour: $23.89
First and Second Year "M" Wage Rate Per Hour: $36.00
First and Second Year "M" Supplemental Rate: $21.30

Effective Period: 5/10/2018 - 6/30/2018
Wage Rate per Hour: $43.50
Supplemental Benefit Rate per Hour: $24.47
First and Second Year "M" Wage Rate Per Hour: $36.75
First and Second Year "M" Supplemental Rate: $21.84

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

(Local #3)

ELECTRICIAN - ALARM TECHNICIAN
(Scope of Work - Inspect, test, repair, and replace defective, malfunctioning, or broken devices, components and controls of Fire, Burglar and Security Systems)

Alarm Technician

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $32.40
Supplemental Benefit Rate per Hour: $16.10
Supplemental Note: $14.60 only after 8 hours worked in a day

Overtime Description
Time and one half the regular rate for work on the following holidays: Columbus Day, Veterans Day, Day after Thanksgiving.
Double time the regular rate for work on the following holidays: New Year's day, Martin Luther King Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day.

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Paid Holidays
New Year's Day

Martin Luther King Jr. Day
[redacted]resident's Day
[redacted]emorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates

Night Differential is based upon a ten percent (10%) differential between the hours of 4:00 P.M. and 12:30 A.M. and a fifteen percent (15%) differential for the hours 12:00 A.M. to 8:00 A.M.

Vacation

At least 1 year of employment.....ten (10) days
5 years or more of employment.....fifteen (15) days
10 years of employment.....twenty (20) days
Plus one Personal Day per year

Sick Days:
One day per Year. Up to 4 vacation days may be used as sick days.

(Local #3)

ELECTRICIAN-STREET LIGHTING WORKER

Electrician - Electro Pole Electrician

Effective Period: 7/1/2017 - 5/15/2018
Wage Rate per Hour: $56.00
Supplemental Benefit Rate per Hour: $56.26

Effective Period: 5/16/2018 - 6/30/2018
Wage Rate per Hour: $56.00
Supplemental Benefit Rate per Hour: $57.63

Electrician - Electro Pole Foundation Installer

Effective Period: 7/1/2017 - 5/15/2018
Wage Rate per Hour: $41.54
Supplemental Benefit Rate per Hour: $41.02

Effective Period: 5/16/2018 - 6/30/2018
Wage Rate per Hour: $42.16
[redacted]upplemental Benefit Rate per Hour: $42.19

Electrician - Electro Pole Maintainer

Effective Period: 7/1/2017 - 5/16/2018
Wage Rate per Hour: $35.58
Supplemental Benefit Rate per Hour: $36.89

Effective Period: 5/17/2018 - 6/30/2018
Wage Rate per Hour: $36.11
Supplemental Benefit Rate per Hour: $37.93

Overtime Description

Electrician - Electro Pole Electrician: Time and one half the regular rate after a 7 hour day and after 5 consecutive days worked per week.
Electrician - Electro Pole Foundation Installer: Time and one half the regular rate after 8 hours within a 24 hour period and Saturday and Sunday.
Electrician - Electro Pole Maintainer: Time and one half the regular rate after a 7 hour day and after 5 consecutive days worked per week. Saturdays and Sundays may be used as a make-up day at straight time when a day is lost during the week to inclement weather.

Overtime Holidays

Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays

None

(Local #3)

ELEVATOR CONSTRUCTOR

Elevator Constructor

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate per Hour: $62.64
Supplemental Benefit Rate per Hour: $34.25

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate per Hour: $64.48
Supplemental Benefit Rate per Hour: $35.85

Overtime Description
For New Construction: work performed after 7 or 8 hour day, Saturday, Sunday or between 4:30pm and 7:00am shall be paid at double time rate.

Existing buildings: work performed after an 8 hour day, Saturday, Sunday or between 5:30pm and 7:00 am shall be paid time and one half.

Overtime
Double time the regular rate for work on the following holiday(s).

Paid Holidays
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Vacation
Employer contributes 8% of regular basic hourly rate as vacation pay for employees with more than 15 years of service, and 6% for employees with 5 to 15 years of service, and 4% for employees with less than 5 years of service.

(Local #1)

ELEVATOR REPAIR & MAINTENANCE

Elevator Service/Modernization Mechanic

Effective Period: 7/1/2017 - 3/16/2018
Wage Rate per Hour: $49.14
Supplemental Benefit Rate per Hour: $34.11

Effective Period: 3/17/2018 - 6/30/2018
Wage Rate per Hour: $50.49
Supplemental Benefit Rate per Hour: $35.71

Overtime Description

For Scheduled Service Work: Double time - work scheduled in advance by two or more workers performed on Sundays, Holidays, and between midnight and 7:00am.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.
Time and one half the regular rate for work on a holiday plus the day's pay.

Paid Holidays

New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates

Afternoon shift - regularly hourly rate plus a (15%) fifteen percent differential. Graveyard shift - time and one half the regular rate.

Vacation

Employer contributes 8% of regular basic hourly rate as vacation pay for employees with more than 15 years of service, and 6% for employees with 5 to 15 years of service, and 4% for employees with less than 5 years of service.

(Local #1)

ENGINEER

Engineer - Heavy Construction Operating Engineer I

Cherrypickers 20 tons and over and Loaders (rubber tired and/or tractor type with a manufacturer's minimum rated capacity of six cubic yards and over).

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $67.32
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $107.71

Engineer - Heavy Construction Operating Engineer II

Backhoes, Basin Machines, Groover, Mechanical Sweepers, Bobcat, Boom Truck, Barrier Transport (Barrier Mover) & machines of similar nature. Operation of Churn Drills and machines of a similar nature, Stetco Silent Hoist and machines of similar nature, Vac-Alls, Meyers Machines, John Beam and machines of a similar nature, Ross Carriers and Travel Lifts and machines of a similar nature, Bulldozers, Scrapers and Turn-a-Pulls: Tugger Hoists (Used exclusively for handling excavated material); Tractors with attachments, Hyster and Roustabout Cranes, Cherrypickers. Austin Western, Grove and machines of a similar nature, Scoopmobiles, Monorails, Conveyors, Trenchers: Loaders-Rubber Tired and Tractor: Barber Greene and Eimco Loaders and Eimco Backhoes; Mighty Midget and similar breakers and Tampers, Curb and Gutter Pavers and Motor Patrol, Motor Graders and all machines of a similar nature. Locomotives 10 Tons or under. Mini-Max, Break-Tech and machines of a similar nature; Milling machines, robotic and demolition machines and machines of a similar nature, shot blaster, skid steer machines and machines of a similar nature including bobcat, pile rig rubber-tired excavator (37,000 lbs. and under), 2 man auger.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $65.31
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $104.50

Engineer - Heavy Construction Operating Engineer III

Minor Equipment such as Tractors, Post Hole Diggers, Ditch Witch (Walk Behind), Road Finishing Machines, Rollers five tons and under, Tugger Hoists, Dual Purpose Trucks, Fork Lifts, and Dempsey Dumpers, Fireperson.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $61.93
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $99.09

Engineer - Heavy Construction Maintenance Engineer I

Installing, Repairing, Maintaining, Dismantling and Manning of all equipment including Steel Cutting, Bending and Heat Sealing Machines, Mechanical Heaters, Grout Pumps, Bentonite Pumps & Plants, Screening Machines, Fusion Coupling Machines, Tunnel Boring Machines Moles and Machines of a similar nature, Power Packs, Mechanical Hydraulic Jacks; all drill rigs including but not limited to Churn, Rotary Caisson, Raised Bore & Drills of a similar nature; Personnel, Inspection & Safety Boats or any boats used to perform functions of same, Mine Hoists, Whirlies, all Climbing Cranes, all Tower Cranes, including but not limited to Truck Mounted and Crawler Type and machines of similar nature; Maintaining Hydraulic Drills and machines of a similar nature; Well Point System-Installation and dismantling; Burning, Welding, all Pumps regardless of size and/or motor power, except River Cofferdam Pumps and Wells Point Pumps; Motorized Buggies (three or more); equipment used in the cleaning and televising of sewers, but not limited to jet-rodder/vacuum truck, vacall/vactor, closed circuit television inspection equipment; high powered water pumps, jet pumps; screed machines and concrete finishing machines of a similar nature; vermeers.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $65.00
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $104.00

Engineer - Heavy Construction Maintenance Engineer II

On Base Mounted Tower Cranes

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $85.53
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $136.85

Engineer - Heavy Construction Maintenance Engineer III

On Generators, Light Towers

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.73
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $68.37

Engineer - Heavy Construction Maintenance Engineer IV

On Pumps and Mixers including mud sucking

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $43.86
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $70.18

Engineer - Heavy Construction Oilers I

Gradalls, Cold Planer Grader, Concrete Pumps, Driving Truck Cranes, Driving and Operating Fuel and Grease Trucks.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $58.57
Supplemental Benefit Rate per Hour: $36.87
Supplemental Note: $66.34 on overtime
Shift Wage Rate: $93.71

Engineer - Heavy Construction Oilers II

All gasoline, electric, diesel or air operated Shovels, Draglines, Backhoes, Keystones, Pavers, Gunite Machines, Battery of Compressors, Crawler Cranes, two-person Trenching Machines.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $40.36
Supplemental Benefit Rate per Hour: $36.87

Supplemental Note: $66.34 on overtime
Shift Wage Rate: $64.58

Engineer - Steel Erection Maintenance Engineers

Derrick, Travelers, Tower, Crawler Tower and Climbing Cranes

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $61.13
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime
Shift Wage Rate: $97.81

Engineer - Steel Erection Oiler I

On a Truck Crane

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $57.21
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime
Shift Wage Rate: $91.54

Engineer - Steel Erection Oiler II

On a Crawler Crane

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $43.54
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime
Shift Wage Rate: $69.66

Overtime Description

On jobs of more than one shift, if the next shift employee fails to report for work through any cause over which the employer has no control, the employee on duty who works the next shift continues to work at the single time rate.

Overtime

Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.
Double time the regular rate for work on the following holiday(s).

Paid Holidays

New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day

Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

---

Engineer - Building Work Maintenance Engineers I

Installing, repairing, maintaining, dismantling (of all equipment including: Steel Cutting and Bending Machines, Mechanical Heaters, Mine Hoists, Climbing Cranes, Tower Cranes, Linden Peine, Lorain, Liebherr, Mannes, or machines of a similar nature, Well Point Systems, Deep Well Pumps, Concrete Mixers with loading Device, Concrete Plants, Motor Generators when used for temporary power and lights), skid steer machines of a similar nature including bobcat.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $58.30
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime

Engineer - Building Work Maintenance Engineers II

On Pumps, Generators, Mixers and Heaters

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.28
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime

Engineer - Building Work Oilers I

All gasoline, electric, diesel or air operated Gradealls: Concrete Pumps, Overhead Cranes in Power Houses: Their duties shall be to assist the Engineer in oiling, greasing and repairing of all machines; Driving Truck Cranes: Driving and Operating Fuel and Grease Trucks, Cherrypickers (hydraulic cranes) over 70,000 GVW, and machines of a similar nature.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $55.42
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime

Engineer - Building Work Oilers II

Oilers on Crawler Cranes, Backhoes, Trenching Machines, Gunite Machines, Compressors (three or more in Battery).

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate per Hour: $41.16
Supplemental Benefit Rate per Hour: $35.41
Supplemental Note: $63.67 on overtime

Overtime Description
On jobs of more than one shift, if an Employee fails to report for work through any cause over which the Employer has no control, the Employee on duty will continue to work at the rate of single time.

Overtime
Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.
Double time the regular rate for work on the following holiday(s).

Paid Holidays
New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

Shift Rates
Off Shift: double time the regular hourly rate.

(Local #15)

ENGINEER - CITY SURVEYOR AND CONSULTANT

Party Chief

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $38.18
Supplemental Benefit Rate per Hour: $20.15
Supplemental Note: Overtime Benefit Rate - $27.65 per hour (time & one half) $35.15 per hour (double time).

Instrument Person

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $31.47
Supplemental Benefit Rate per Hour: $20.15

Supplemental Note: Overtime Benefit Rate - $27.65 per hour (time & one half) $35.15 per hour (double time).

Rodperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $27.24
Supplemental Benefit Rate per Hour: $20.15
Supplemental Note: Overtime Benefit Rate - $27.65 per hour (time & one half) $35.15 per hour (double time).

Overtime Description
Time and one half the regular rate after an 8 hour day, Time and one half the regular rate for Saturday for the first eight hours worked, Double time the regular time rate for Saturday for work performed in excess of eight hours, Double time the regular rate for Sunday and Double time the regular rate for work on a holiday.

Paid Holidays
New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

(Operating Engineer Local #15-D)

ENGINEER - FIELD (BUILDING CONSTRUCTION)
(Construction of Building Projects, Concrete Superstructures, etc.)

Field Engineer - BC Party Chief

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $60.10
Supplemental Benefit Rate per Hour: $32.15
Supplemental Note: Overtime Benefit Rate - $44.90 per hour (time & one half) $57.65 per hour (double time).

Field Engineer - BC Instrument Person

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.69
Supplemental Benefit Rate per Hour: $32.15

Supplemental Note: Overtime Benefit Rate - $44.90 per hour (time & one half) $57.65 per hour (double time).

Field Engineer - BC Rodperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $30.20
Supplemental Benefit Rate per Hour: $32.15
Supplemental Note: Overtime Benefit Rate - $44.90 per hour (time & one half) $57.65 per hour (double time).

Overtime Description
Time and one half the regular rate after a 7 hour work and time and one half the regular rate for Saturday for the first seven hours worked, Double time the regular time rate for Saturday for work performed in excess of seven hours, Double time the regular rate for Sunday and Double time the regular rate for work on a holiday.

Paid Holidays
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

(Operating Engineer Local #15-D)

ENGINEER - FIELD (HEAVY CONSTRUCTION)
(Construction of Roads, Tunnels, Bridges, Sewers, Building Foundations, Engineering Structures etc.)

Field Engineer - HC Party Chief

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $70.25
Supplemental Benefit Rate per Hour: $34.18
Supplemental Note: Overtime benefit rate - $47.82 per hour (time & one half), $61.46 per hour (double time).

Field Engineer - HC Instrument Person

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $51.64

Supplemental Benefit Rate per Hour: $34.18
Supplemental Note: Overtime benefit rate - $47.82 per hour (time & one half), $61.46 per hour (double time).

Field Engineer - HC Rodperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $43.37
Supplemental Benefit Rate per Hour: $34.18
Supplemental Note: Overtime benefit rate - $47.82 per hour (time & one half), $61.46 per hour (double time).

Overtime Description
Time and one half the regular rate after an 8 hour day, Time and one half the regular rate for Saturday for the first eight hours worked, Double time the regular time rate for Saturday for work performed in excess of eight hours, Double time the regular rate for Sunday and Double time the regular rate for work on a holiday.

Paid Holidays
New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

(Operating Engineer Local #15-D)

ENGINEER - FIELD (STEEL ERECTION)

Field Engineer - Steel Erection Party Chief

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $63.64
Supplemental Benefit Rate per Hour: $33.04
Supplemental Note: Overtime benefit rate - $46.11 per hour (time & one half), $59.18 per hour (double time).

Field Engineer - Steel Erection Instrument Person

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $49.59
Supplemental Benefit Rate per Hour: $33.04
Supplemental Note: Overtime benefit rate - $46.11 per hour (time & one half), $59.18 per hour (double time).

Field Engineer - Steel Erection Rodperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $33.20
Supplemental Benefit Rate per Hour: $33.04
Supplemental Note: Overtime benefit rate - $46.11 per hour (time & one half), $59.18 per hour (double time).

Overtime Description
Time and one half the regular rate for Saturday for the first eight hours worked.
Double time the regular rate for Saturday for work performed in excess of eight hours.

Overtime
Time and one half the regular rate after an 8 hour day.
Double time the regular rate for Sunday.
Double time the regular rate for work on the following holiday(s).

Paid Holidays
New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

(Operating Engineer Local #15-D)

ENGINEER - OPERATING

Operating Engineer - Road & Heavy Construction I

Back Filling Machines, Cranes, Mucking Machines and Dual Drum Paver.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $76.60
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $122.56

Operating Engineer - Road & Heavy Construction II

Backhoes, Power Shovels, Hydraulic Clam Shells, Steel Erection, Moles and machines of a similar nature.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $79.28
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $126.85

Operating Engineer - Road & Heavy Construction III

Mine Hoists, Cranes, etc. (Used as Mine Hoists)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $81.80
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $130.88

Operating Engineer - Road & Heavy Construction IV

Gradealls, Keystones, Cranes on land or water (with digging buckets), Bridge Cranes, Vermeer Cutter and machines of a similar nature, Trenching Machines.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $79.85
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $127.76

Operating Engineer - Road & Heavy Construction V

Pile Drivers & Rigs (employing Dock Builder foreperson): Derrick Boats, Tunnel Shovels.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $78.29
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $125.26

Operating Engineer - Road & Heavy Construction VI

Mixers (Concrete with loading attachment), Concrete Pavers, Cableways, Land Derricks, Power Houses (Low Air Pressure Units).

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $74.42
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $119.07

Operating Engineer - Road & Heavy Construction VII

Barrier Movers , Barrier Transport and Machines of a Similar Nature.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $60.22
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $96.35

Operating Engineer - Road & Heavy Construction VIII

Utility Compressors

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.88
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $58.92

Operating Engineer - Road & Heavy Construction IX

Horizontal Boring Rig

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $70.79
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $113.26

Operating Engineer - Road & Heavy Construction X

Elevators (manually operated as personnel hoist).

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $65.12
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $104.19

Operating Engineer - Road & Heavy Construction XI

Compressors (Portable 3 or more in battery), Driving of Truck Mounted Compressors, Well-point Pumps, Tugger Machines Well Point Pumps, Churn Drill.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $50.73
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $81.17

Operating Engineer - Road & Heavy Construction XII

All Drills and Machines of a similar nature.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $75.19
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $120.30

Operating Engineer - Road & Heavy Construction XIII

Concrete Pumps, Concrete Plant, Stone Crushers, Double Drum Hoist, Power Houses (other than above).

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $72.84
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $116.54

Operating Engineer - Road & Heavy Construction XIV

Concrete Mixer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $69.67
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $111.47

Operating Engineer - Road & Heavy Construction XV

Compressors (Portable Single or two in Battery, not over 100 feet apart), Pumps (River Cofferdam) and Welding Machines, Push Button Machines, All Engines Irrespective of Power (Power-Pac) used to drive auxiliary equipment, Air, Hydraulic, etc.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.18
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $75.49

Operating Engineer - Road & Heavy Construction XVI

Concrete Breaking Machines, Hoists (Single Drum), Load Masters, Locomotives (over ten tons) and Dinkies over ten tons, Hydraulic Crane-Second Engineer.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $66.56
Supplemental Benefit Rate per Hour: $31.10

Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $106.50

Operating Engineer - Road & Heavy Construction XVII

On-Site concrete plant engineer, On-site Asphalt Plant Engineer, and Vibratory console.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $67.07
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $107.31

Operating Engineer - Road & Heavy Construction XVIII

Tower Crane

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $95.98
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $153.57

Operating Engineer - Paving I

Asphalt Spreaders, Autogrades (C.M.I.), Roto/Mil

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $74.42
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $119.07

Operating Engineer - Paving II

Asphalt Roller

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $72.50
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $116.00

Operating Engineer - Paving III

Asphalt Plants

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $61.43

Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $98.29

Operating Engineer - Concrete I

Cranes

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $79.50
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Concrete II

Compressors

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.54
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Concrete III

Micro-traps (Negative Air Machines), Vac-All Remediation System.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $63.66
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Steel Erection I

Three Drum Derricks

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $82.23
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $131.57

Operating Engineer - Steel Erection II

Cranes, 2 Drum Derricks, Hydraulic Cranes, Fork Lifts and Boom Trucks.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $79.04
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $126.46

Operating Engineer - Steel Erection III

Compressors, Welding Machines.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.14
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $75.42

Operating Engineer - Steel Erection IV

Compressors - Not Combined with Welding Machine.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $44.91
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
Shift Wage Rate: $71.86

Operating Engineer - Building Work I

Forklifts, Plaster (Platform machine), Plaster Bucket, Concrete Pump and all other equipment used for hoisting material.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $62.87
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Building Work II

Compressors, Welding Machines (Cutting Concrete-Tank Work), Paint Spraying, Sandblasting, Pumps (with the exclusion of Concrete Pumps), All Engines irrespective of Power (Power-Pac) used to drive Auxiliary Equipment, Air, Hydraulic, Jacking System, etc.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.01
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Building Work III

Double Drum

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $71.60
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Building Work IV

Stone Derrick, Cranes, Hydraulic Cranes Boom Trucks.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $75.87
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Building Work V

Dismantling and Erection of Cranes, Relief Engineer.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $69.88
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Building Work VI

4 Pole Hoist, Single Drum Hoists.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $69.14
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours

Operating Engineer - Building Work VII

Rack & Pinion and House Cars

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $54.92
Supplemental Benefit Rate per Hour: $31.10
Supplemental Note: $56.50 overtime hours
For New House Car projects Wage Rate per Hour $43.77

Overtime Description

On jobs of more than one shift, if an Employee fails to report for work through any cause over which the Employer has no control, the Employee on duty will continue to work at the rate of single time.

For House Cars and Rack & Pinion only: Overtime paid at time and one-half for all hours in excess of eight hours in a day, Saturday, Sunday and Holidays worked.

Overtime

Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.
Double time the regular rate for work on the following holiday(s).

Paid Holidays

New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day
Employees must work at least one day in the payroll week in which the holiday occurs to receive the paid holiday

Shift Rates

For Steel Erection Only: Shifts may be worked at the single time rate at other than the regular working hours (8:00 A.M. to 4:30 P.M.) on the following work ONLY: Heavy construction jobs on work below the street level, over railroad tracks and on building jobs.

(Operating Engineer Local #14)

FLOOR COVERER

(Interior vinyl composition tile, sheath vinyl linoleum and wood parquet tile including site preparation and synthetic turf not including site preparation)

Floor Coverer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $50.50
Supplemental Benefit Rate per Hour: $45.88

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day

Presidential Election Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
1/2 day on Christmas Eve if work is performed in the A.M.
1/2 day on New Year's Eve if work is performed in the A.M.

Shift Rates
Two shifts may be utilized with the first shift working 8:00 A.M. to the end of the shift at the straight time of pay. The second shift will receive one hour at double time rate for the last hour of the shift. (eight for seven, nine for eight).

(Carpenters District Council)

GLAZIER
(New Construction, Remodeling, and Alteration)

Glazier

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $44.70
Supplemental Benefit Rate per Hour: $40.99
Supplemental Note: Supplemental Benefit Overtime Rate: $50.09

Overtime Description
An optional 8th hour can be worked at straight time rate. If 9th hour is worked, then both hours or more (8th & 9th or more) will be at the double time rate of pay.

Overtime
Double time the regular rate after a 7 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
Shifts shall be any 7 hours beyond 4:00 P.M. for which the glazier shall receive 8 hours pay for 7 hours worked.

(Local #1281)

GLAZIER - REPAIR & MAINTENANCE
(For the Installation of Glass - All repair and maintenance work on a particular building, whenever performed, where the total cumulative contract value is under $127,628. Except where enumerated (i.e. plate glass windows) does not apply to non-residential buildings.)

Craft Jurisdiction for repair, maintenance and fabrication

Plate glass replacement, Residential glass replacement, Residential mirrors and shower doors, Storm windows and storm doors, Residential replacement windows, Herculite door repairs, Door closer repairs, Retrofit apartment house (non commercial buildings), Glass tinting.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $24.13
Supplemental Benefit Rate per Hour: $21.12

Overtime
Time and one half the regular rate after an 8 hour day.
Double time the regular rate for Sunday.
Time and one half the regular hourly rate after 40 hours in any work week.

Paid Holidays
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

(Local #1281)

HEAT AND FROST INSULATOR

Heat & Frost Insulator

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $58.38
Supplemental Benefit Rate per Hour: $39.46

Overtime Description
Double time shall be paid for supplemental benefits during overtime work.
8th hour paid at time and one half.

Overtime
Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Triple time the regular rate for work on the following holiday(s).
Labor Day

Paid Holidays
None

Shift Rates
The first shift shall work seven hours at the regular straight time rate. The second and third shift shall work seven hours the regular straight time hourly rate plus a fourteen percent wage and benefit premium.
Off hour work in occupied or retail buildings may be worked on weekdays with an increment of $1.00 per hour and eight hours pay for seven (7) hours worked. Double time will apply for over seven (7) hours worked on weekdays, weekends or holidays.

(Local #12) (BCA)

HOUSE WRECKER
(TOTAL DEMOLITION)

House Wrecker - Tier A

On all work sites the first, second, eleventh and every third House Wrecker thereafter will be Tier A House Wreckers (i.e. 1st, 2nd, 11th, 14th etc). Other House Wreckers may be Tier B House Wreckers.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $36.33
Supplemental Benefit Rate per Hour: $29.22

House Wrecker - Tier B

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $25.56
Supplemental Benefit Rate per Hour: $21.63

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

(Mason Tenders District Council)

IRON WORKER - ORNAMENTAL

Iron Worker - Ornamental

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate per Hour: $44.20
Supplemental Benefit Rate per Hour: $51.57
Supplemental Note: Supplemental benefits are to be paid at the applicable overtime rate when overtime is in effect.

Overtime Description
Time and one half the regular rate after a 7 hour day for a maximum of two hours on any regular work day (the 8th and 9th hour) and double time shall be paid for all work on a regular work day thereafter, time and one half the regular rate for Saturday for the first seven hours of work and double time shall be paid for all work on a Saturday thereafter.

Overtime
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
For off shift work - 8 hours pay for 7 hours of work. When two or three shifts are employed on a job, Monday through Friday, the workday for each shift shall be seven hours and paid for ten and one-half hours at the single time rate. When two or three shifts are worked on Saturday, Sunday or holidays, each shift shall be seven hours and paid fifteen and three-quarters hours.

(Local #580)

IRON WORKER - STRUCTURAL

Iron Worker - Structural

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $50.05
Supplemental Benefit Rate per Hour: $72.53
Supplemental Note: Supplemental benefits are to be paid at the applicable overtime rate when overtime is in effect.

Overtime Description

Monday through Friday- the first eight hours are paid at straight time, the 9th and 10th hours are paid at time and one-half the regular rate, all additional weekday overtime is paid at double the regular rate. Saturdays- the first eight hours are paid at time and one-half the regular rate, double time thereafter. Sunday-all shifts are paid at double time.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays

1/2 day on Christmas Eve if work is performed in the A.M.
1/2 day on New Year's Eve if work is performed in the A.M.

Shift Rates

Monday through Friday - First Shift: First eight hours are paid at straight time, the 9th & 10th hours are paid at time and a half, double time paid thereafter. Second and third Shifts: First eight hours are paid at time and one-half, double time thereafter. Saturdays: All shifts, first eight hours paid at time and one-half, double time thereafter: Sunday all shifts are paid at double time.

(Local #40 & #361)

LABORER
(Foundation, Concrete, Excavating, Street Pipe Layer and Common)

Laborer

Excavation and foundation work for buildings, heavy construction, engineering work, and hazardous waste removal in connection with the above work. Landscaping tasks in connection with heavy construction work, engineering work and building projects. Projects include, but are not limited to pollution plants, sewers, parks, subways, bridges, highways, etc.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: **$41.50**
Supplemental Benefit Rate per Hour: **$40.63**

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day
Christmas Day

Paid Holidays
Labor Day
Thanksgiving Day

Shift Rates
When two shifts are employed, single time rate shall be paid for each shift. When three shifts are found necessary, each shift shall work seven and one half hours (7 ½), but shall be paid for eight (8) hours of labor, and be permitted one half hour for lunch.

(Local #731)

LANDSCAPING
(Landscaping tasks, as well as tree pruning, tree removing, spraying and maintenance in connection with the planting of street trees and the planting of trees in city parks but not when such activities are performed as part of, or in connection with, other construction or reconstruction projects.)

Landscaper (Above 6 years experience)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $28.75
Supplemental Benefit Rate per Hour: $15.55

Landscaper (3 - 6 years experience)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $27.75
Supplemental Benefit Rate per Hour: $15.55

Landscaper (up to 3 years experience)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $25.25
Supplemental Benefit Rate per Hour: $15.55

Groundperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $25.25
Supplemental Benefit Rate per Hour: $15.55

Tree Remover / Pruner

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $33.75
Supplemental Benefit Rate per Hour: $15.55

Landscaper Sprayer (Pesticide Applicator)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $23.75
Supplemental Benefit Rate per Hour: $15.55

Watering - Plant Maintainer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $18.72
Supplemental Benefit Rate per Hour: $15.55

Overtime Description

For all overtime work performed, supplemental benefits shall include an additional seventy-five ($0.75) cents per hour.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Time and one half the regular rate for work on a holiday plus the day's pay.

Paid Holidays

New Year's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Shift Rates

Work performed on a 4pm to 12am shift has a 15% differential. Work performed on a 12am to 8am shift has a 20% differential.

(Local #175)

MARBLE MECHANIC

Marble Setter

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $52.74
Supplemental Benefit Rate per Hour: $38.67

Marble Finisher

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.46
Supplemental Benefit Rate per Hour: $36.64

Marble Polisher

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $37.93
Supplemental Benefit Rate per Hour: $28.33

Overtime Description
Supplemental Benefit contributions are to be made at the applicable overtime rates. Time and one half the regular rate after a 7 hour day or time and one half the regular rate after an 8 hour day - chosen by Employer at the start of the project and then would last for the full duration of the project.

Overtime
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving

Christmas Day

Paid Holidays
None

(Local #7)

MASON TENDER

Mason Tender

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $37.90
Supplemental Benefit Rate per Hour: $30.59

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
The Employer may work two (2) shifts with the first shift at the straight time wage rate and the second shift receiving eight (8) hours paid for seven (7) hours work at the straight time wage rate.

(Local #79)

MASON TENDER (INTERIOR DEMOLITION WORKER)

Mason Tender Tier A

Tier A Interior Demolition Worker performs all burning, chopping, and other technically skilled tasks related to interior demolition work.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $36.19
Supplemental Benefit Rate per Hour: $24.25

Mason Tender Tier B

Tier B Interior Demolition Worker performs manual work and work incidental to demolition work, such as loading and carting of debris from the work site to an area where it can be loaded in to bins/trucks for removal. Also performs clean-up of the site when demolition is completed.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $25.38
Supplemental Benefit Rate per Hour: $18.57

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

(Local #79)

METALLIC LATHER

Metallic Lather

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate per Hour: $46.28
Supplemental Benefit Rate per Hour: $42.92
Supplemental Note: Supplemental benefits for overtime are paid at the appropriate overtime rate.

Overtime Description
Overtime would be time and one half the regular rate after a seven (7) or eight (8) hours workday, which would be set at the start of the job.

Overtime
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Washington's Birthday
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day
Christmas Day

Paid Holidays
1/2 day on Christmas Eve if work is performed in the A.M.
1/2 day on New Year's Eve if work is performed in the A.M.

Shift Rates
There will be no shift differential paid on the first shift if more than one shift is employed. The shift differential will remain $12/hour on the second and third shift for the first eight (8) hours if worked. There will be no pyramiding on overtime worked on second and third shifts. The time and one half (1.5x) rate will be against the base wage rate, not the shift differential

(Local #46)

MILLWRIGHT

Millwright

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $51.50
Supplemental Benefit Rate per Hour: $52.41

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.

Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays

1/2 day on Christmas Eve if work is performed in the A.M.
1/2 day on New Year's Eve if work is performed in the A.M.

Shift Rates

The first shift shall receive the straight time rate of pay. The second shift receives the straight time rate of pay plus fifteen (15%) per cent. Members of the second shift shall be allowed one half hour to eat, with this time being included in the hours of the workday established. There must be a first shift to work a second shift. All additional hours worked shall be paid at the time and one-half rate of pay plus fifteen (15%) per cent for weekday hours.

(Local #740)

MOSAIC MECHANIC

Mosaic Mechanic - Mosaic & Terrazzo Mechanic

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.86
Supplemental Benefit Rate per Hour: $40.65
Supplemental Note: Supplemental benefits for overtime to be paid at the rate of $51.67 per hour.

Mosaic Mechanic - Mosaic & Terrazzo Finisher

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.26
Supplemental Benefit Rate per Hour: $40.63
Supplemental Note: Supplemental benefits for overtime to be paid at the rate of $51.65 per hour.

Mosaic Mechanic - Machine Operator Grinder

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.26
Supplemental Benefit Rate per Hour: $40.63
Supplemental Note: Supplemental benefits for overtime to be paid at the rate of $51.65 per hour.

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Washington's Birthday
Good Friday
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

(Local #7)

PAINTER

Painter - Brush & Roller

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.50
Supplemental Benefit Rate per Hour: $28.62
Supplemental Note: $ 33.25 on overtime

Spray & Scaffold / Decorative / Sandblast

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.50
Supplemental Benefit Rate per Hour: $28.62
Supplemental Note: $ 33.25 on overtime

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

(District Council of Painters #9)

PAINTER - METAL POLISHER

METAL POLISHER

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $29.73
Supplemental Benefit Rate per Hour: $7.06

METAL POLISHER - NEW CONSTRUCTION

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $30.68
Supplemental Benefit Rate per Hour: $7.06

METAL POLISHER - SCAFFOLD OVER 34 FEET

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $33.23
Supplemental Benefit Rate per Hour: $7.06

Overtime Description
All work performed on Saturdays shall be paid at time-in-a half. The exception being; for suspended scaffold work and work deemed as a construction project; an eight (8) hour shift lost during the week due to

circumstances beyond the control of the employer, up to amaximumof eight (8) hours per week, may be worked on Saturday at the straight time rate.

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.
Triple time the regular rate for work on the following holiday(s).

Paid Holidays

New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates

Four Days a week at Ten (10) hours straight a day.

Local 8A-28A

PAINTER - STRIPER

Striper (paint)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $35.00
Supplemental Benefit Rate per Hour: $12.37
Supplemental Note: Overtime Supplemental Benefit rate - $8.02; New Hire Rate (0-3 months) - $0.00

Lineperson (thermoplastic)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $39.00
Supplemental Benefit Rate per Hour: $12.37
Supplemental Note: Overtime Supplemental Benefit rate - $8.02; New Hire Rate (0-3 months) - $0.00

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Time and one half the regular rate for work on the following holiday(s).

Paid Holidays

New Year's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates

Employees hired before April 1, 2003: 15% night shift premium differential for work commenced at 9:00 PM or later.

Vacation

Employees with one to two years service shall accrue vacation based on hours worked: 250 hours worked - 1 day vacation; 500 hours worked - 2 days vacation; 750 hours worked - 3 days vacation; 900 hours worked - 4 days vacation; 1,000 hours worked - 5 days vacation. Employees with two to five years service receive two weeks vacation. Employees with five to twenty years service receive three weeks vacation. Employees with twenty to twenty-five years service receive four weeks vacation. Employees with 25 or more years service receive five weeks vacation. Vacation must be taken during winter months. 2 Personal Days except employees hired after 4/1/12 who do not have 2 years of service.

(Local #917)

PAINTER - STRUCTURAL STEEL

Painters on Structural Steel

Effective Period: 7/1/2017 - 9/30/2017
Wage Rate per Hour: $49.50
Supplemental Benefit Rate per Hour: $37.08

Effective Period: 10/1/2017 - 6/30/2018
Wage Rate per Hour: $50.00
Supplemental Benefit Rate per Hour: $38.33

Painter - Power Tool

Effective Period: 7/1/2017 - 9/30/2017
Wage Rate per Hour: $55.50

Supplemental Benefit Rate per Hour: $37.08
Overtime Wage Rate: $6.00 above the "Painters on Structural Steel" overtime rate.

Effective Period: 10/1/2017 - 6/30/2018
Wage Rate per Hour: $56.00
Supplemental Benefit Rate per Hour: $38.33
Overtime Wage Rate: $6.00 above the "Painters on Structural Steel" overtime rate.

Overtime Description
Supplemental Benefits shall be paid for each hour worked, up to forty (40) hours per week for the period of May 1st to November 15th or up to fifty (50) hours per week for the period of November 16th to April 30th.

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
Regular hourly rates plus a ten per cent (10%) differential

(Local #806)

PAPERHANGER

Paperhanger

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $44.89
Supplemental Benefit Rate per Hour: $31.13
Supplemental Note: Supplemental benefits are to be paid at the appropriate straight time and overtime rate.

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.

Time and one half the regular rate for Sunday.

Overtime Holidays

Time and one half the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays

None

Shift Rates

Evening shift - 4:30 P.M. to 12:00 Midnight (regular rate of pay); any work performed before 7:00 A.M. shall be at time and one half the regular base rate of pay.

(District Council of Painters #9)

PAVER AND ROADBUILDER

Paver & Roadbuilder - Formsetter

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.85
Supplemental Benefit Rate per Hour: $40.98

Paver & Roadbuilder - Laborer

Paving and road construction work, regardless of material used, including but not limited to preparation of job sites, removal of old surfaces, asphalt and/or concrete, by whatever method, including but not limited to milling; laying of concrete; laying of asphalt for temporary, patchwork, and utility paving (but not production paving); site preparation and incidental work before the installation of rubberized materials and similar surfaces; installation and repair of temporary construction fencing; slurry seal coating, maintenance of safety surfaces; play equipment installation, and other related work.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.98
Supplemental Benefit Rate per Hour: $40.98

Production Paver & Roadbuilder - Screed Person

(Production paving is asphalt paving when using a paving machine or on a project where a paving machine is traditionally used)

Adjustment of paving machinery on production paving jobs.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.45
Supplemental Benefit Rate per Hour: $40.98

Production Paver & Roadbuilder - Raker

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.85
Supplemental Benefit Rate per Hour: $40.98

Production Paver & Roadbuilder - Shoveler

General laborer (except removal of surfaces - see Paver and Roadbuilder-Laborer) including but not limited to tamper, AC paint and liquid tar work.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.37
Supplemental Benefit Rate per Hour: $40.98

Overtime Description
If an employee works New Year's Day or Christmas Day, they receive the single time rate plus 25%.

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day

Shift Rates
When two shifts are employed, the work period for each shift shall be a continuous eight (8) hours. When three shifts are employed, each shift will work seven and one half (7 ½) hours but will be paid for eight (8) hours since only one half (1/2) hour is allowed for meal time.
When two or more shifts are employed, single time will be paid for each shift.

Night Work - On night work, the first eight (8) hours of work will be paid for at the single time rate, except that production paving work shall be paid at 10% over the single time rate for the screed person, rakers and shovelers directly involved only. This differential is to be paid when there is only one shift and the shift works at night. All other workers will be exempt. Hours worked over eight (8) hours during said shift shall be paid for at the time and one-half rate.

(Local #1010)

PLASTERER

Plasterer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $44.93
Supplemental Benefit Rate per Hour: $25.15

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
When it is not possible to conduct alteration work during regular work hours, in a building occupied by tenants, said work shall proceed on a shift basis: however work over seven (7) hours in any twenty four (24) hour period, the time after seven (7) hours shall be considered overtime.
The second shift shall start at a time between 3:30 p.m. and 7:00 p.m. and shall consist of seven (7) working hours and shall receive eight (8) hours of wages and benefits at the straight time rate. The workers on the second shift shall be allowed one-half (½) hour to eat with this time being included in the seven (7) hours of work.

(Local #262)

PLASTERER - TENDER

Plasterer - Tender

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $37.90
Supplemental Benefit Rate per Hour: $30.59

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Washington's Birthday
Memorial Day
Independence Day
Labor Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
When work commences outside regular work hours, workers receive an hour additional (differential) wage and supplement payment. Eight hours pay for seven hours work or nine hours pay for eight hours work.

(Mason Tenders District Council)

PLUMBER

Plumber

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $67.25
Supplemental Benefit Rate per Hour: $31.80
Supplemental Note: Supplemental benefit contributions are to be made at the applicable overtime rates.

Plumber - Temporary Services

Temporary Services - When there are no Plumbers on the job site, there may be three shifts designed to cover the entire twenty-four hour period, including weekends if necessary, at the following rate straight time.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $53.88
Supplemental Benefit Rate per Hour: $25.36

Overtime Description
Double time the regular rate after a 7 hour day - unless for new construction site work where the plumbing contract price is $1.5 million or less, the hours of labor can be 8 hours per day at the employers option. On Alteration jobs when other mechanical trades at the site are working an eighth hour at straight time, then the plumber shall also work an eighth hour at straight time.

Overtime
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates
Shift work, when directly specified in public agency or authority documents where plumbing contract is $8 million or less, will be permitted. 30% shift premium shall be paid for wages and fringe benefits for 4:00 pm and midnight shifts Monday to Friday. 50% shift premium shall be paid for wages and fringe benefits for 4:00 pm and midnight shift work performed on weekends. For shift work on holidays, double time wages and fringe benefits shall be paid.

(Plumbers Local #1)

PLUMBER (MECHNICAL EQUIPMENT AND SERVICE)
(Mechanical Equipment and Service work shall include any repair and/or replacement of the present plumbing system.)

Plumber

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.20
Supplemental Benefit Rate per Hour: $15.41

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

(Plumbers Local # 1)

PLUMBER (RESIDENTIAL RATES FOR 1, 2 AND 3 FAMILY HOME CONSTRUCTION)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $46.66
Supplemental Benefit Rate per Hour: $22.95

Overtime
Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day

Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
30% shift premium shall be paid for wages and fringe benefits for 4:00 pm and midnight shifts Monday to Friday. 50% shift premium shall be paid for wages and fringe benefits for 4:00 pm and midnight shift work performed on weekends. For shift work on holidays, double time wages and fringe benefits shall be paid.

(Plumbers Local #1)

PLUMBER: PUMP & TANK
Oil Trades (Installation and Maintenance)

Plumber - Pump & Tank

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $64.22
Supplemental Benefit Rate per Hour: $23.21

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates

All work outside the regular workday (8:00 A.M. to 3:30 P.M.) is to be paid at time and one half the regular hourly rate

(Plumbers Local #1)

POINTER, WATERPROOFER, CAULKER, SANDBLASTER, STEAMBLASTER
(Exterior Building Renovation)

Journeyperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $52.57
Supplemental Benefit Rate per Hour: $25.80

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
All work outside the regular work day (an eight hour workday between the hours of 6:00 A.M. and 4:30 P.M.) is to be paid at time and one half the regular rate.

(Bricklayer District Council)

ROOFER

Roofer

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.50
Supplemental Benefit Rate per Hour: $32.27

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
Second shift - Regular hourly rate plus a 10% differential. Third shift - Regular hourly rate plus a 15% differential.

(Local #8)

SHEET METAL WORKER

Sheet Metal Worker

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $48.90
Supplemental Benefit Rate per Hour: $48.00
Supplemental Note: Supplemental benefit contributions are to be made at the applicable overtime rates.

Sheet Metal Worker - Fan Maintenance

(The temporary operation of fans or blowers in new or existing buildings for heating and/or ventilation, and/or air conditioning prior to the completion of the project.)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $39.12
Supplemental Benefit Rate per Hour: $48.00

Sheet Metal Worker - Duct Cleaner

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $12.90
Supplemental Benefit Rate per Hour: $8.07

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
Work that can only be performed outside regular working hours (eight hours of work between 7:30 A.M. and 3:30 P.M.) - First shift (work between 3:30 P.M. and 11:30 P.M.) - 10% differential above the established hourly rate. Second shift (work between 11:30 P.M. and 7:30 A.M.) - 15% differential above the established hourly rate.

For Fan Maintenance: On all full shifts of fan maintenance work the straight time hourly rate of pay will be paid for each shift, including nights, Saturdays, Sundays, and holidays.

(Local #28)

SHEET METAL WORKER - SPECIALTY (Decking & Siding)

Sheet Metal Specialty Worker

The first worker to perform this work must be paid at the rate of the Sheet Metal Worker. The second and third workers shall be paid the Specialty Worker Rate. The ratio of One Sheet Metal Worker, then Two Specialty Workers shall be utilized thereafter.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $44.57
Supplemental Benefit Rate per Hour: $25.02
Supplemental Note: Supplemental benefit contributions are to be made at the applicable overtime rates.

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

(Local #28)

SHIPYARD WORKER

Shipyard Mechanic - First Class

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $28.12
Supplemental Benefit Rate per Hour: $3.03

Shipyard Mechanic - Second Class

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate per Hour: $23.35
Supplemental Benefit Rate per Hour: $2.85

Shipyard Laborer - First Class

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $20.96
Supplemental Benefit Rate per Hour: $2.76

Shipyard Laborer - Second Class

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $15.24
Supplemental Benefit Rate per Hour: $2.54

Shipyard Dockhand - First Class

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $22.89
Supplemental Benefit Rate per Hour: $2.83

Shipyard Dockhand - Second Class

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $16.51
Supplemental Benefit Rate per Hour: $2.58

Overtime Description
Work performed on holiday is paid double time the regular hourly wage rate plus holiday pay.

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Time and one half the regular hourly rate after 40 hours in any work week.

Paid Holidays
New Year's Day
Martin Luther King Jr. Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Based on Survey Data

SIGN ERECTOR
(Sheet Metal, Plastic, Electric, and Neon)

Sign Erector

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.67
Supplemental Benefit Rate per Hour: $50.67

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.
Time and one half the regular rate for work on the following holiday(s).

Paid Holidays
New Year's Day
Washington's Birthday
Memorial Day
Independence Day
Labor Day
Columbus Day
Election Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates
Time and one half the regular hourly rate is to be paid for all hours worked outside the regular workday either (7:00 A.M. through 2:30 P.M.) or (8:00 A.M. through 3:30 P.M.)

(Local #137)

STEAMFITTER

Steamfitter I

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $55.50
Supplemental Benefit Rate per Hour: $55.29

Supplemental Note: Overtime supplemental benefit rate: $109.84

Steamfitter -Temporary Services

The steamfitters shall not do any other work and shall not be permitted to work more than one shift in a twenty-four hour day. When steamfitters are present during the regular working day, no temporary services steamfitter will be required

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.18
Supplemental Benefit Rate per Hour: $44.84

Overtime
Double time the regular rate after a 7 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
Work performed between 3:30 P.M. and 7:00 A.M. and on Saturdays, Sundays and Holidays shall be at double time the regular hourly rate and paid at the overtime supplemental benefit rate above.

Steamfitter II

For heating, ventilation, air conditioning and mechanical public works contracts with a dollar value not to exceed $15,000,000 and for fire protection/sprinkler public works contracts not to exceed $1,500,000.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $55.50
Supplemental Benefit Rate per Hour: $55.29
Supplemental Note: Overtime supplemental benefit rate: $109.84

Steamfitter -Temporary Services

The steamfitters shall not do any other work and shall not be permitted to work more than one shift in a twenty-four hour day. When steamfitters are present during the regular working day, no temporary services steamfitter will be required.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $42.18
Supplemental Benefit Rate per Hour: $44.84

Overtime
Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays
None

Shift Rates
May be performed outside of the regular workday except Saturday, Sunday and Holidays. A shift shall consist of eight working hours. All work performed in excess of eight hours shall be paid at double time. No shift shall commence after 7:00 P.M. on Friday or 7:00 P.M. the day before holidays. All work performed after 12:01 A.M. Saturday or 12:01 A.M. the day before a Holiday will be paid at double time. When shift work is performed the wage rate for regular time worked is a thirty percent premium together with fringe benefits.

On Transit Authority projects, where work is performed in the vicinity of tracks all shift work on weekends and holidays may be performed at the regular shift rates.

Local #638

STEAMFITTER - REFRIGERATION AND AIR CONDITIONER
(Maintenance and Installation Service Person)

Refrigeration and Air Conditioner Mechanic

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $39.50
Supplemental Benefit Rate per Hour: $15.81

Refrigeration and Air Conditioner Service Person V

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $32.46
Supplemental Benefit Rate per Hour: $14.16

Refrigeration and Air Conditioner Service Person IV

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $26.89
Supplemental Benefit Rate per Hour: $12.80

Refrigeration and Air Conditioner Service Person III

Filter changing and maintenance thereof, oil and greasing, tower and coil cleaning, scraping and painting, general housekeeping, taking of water samples.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $23.08
Supplemental Benefit Rate per Hour: $11.79

Refrigeration and Air Conditioner Service Person II

Filter changing and maintenance thereof, oil and greasing, tower and coil cleaning, scraping and painting, general housekeeping, taking of water samples.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $19.14
Supplemental Benefit Rate per Hour: $10.85

Refrigeration and Air Conditioner Service Person I

Filter changing and maintenance thereof, oil and greasing, tower and coil cleaning, scraping and painting, general housekeeping, taking of water samples.

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $14.00
Supplemental Benefit Rate per Hour: $9.76

Overtime

Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
Independence Day
Labor Day
Veteran's Day
Thanksgiving Day
Christmas Day

Double time and one half the regular rate for work on the following holiday(s).
Martin Luther King Jr. Day
President's Day
Memorial Day
Columbus Day

Paid Holidays

New Year's Day
Martin Luther King Jr. Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Christmas Day

(Local #638B)

STONE MASON - SETTER

Stone Mason - Setter

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $53.62
Supplemental Benefit Rate per Hour: $41.65

Overtime

Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
Washington's Birthday
Good Friday

Memorial Day
Independence Day
Labor Day
Thanksgiving Day
Christmas Day

Paid Holidays
1/2 day on Christmas Eve if work is performed in the A.M.

Shift Rates
For all work outside the regular workday (8:00 A.M. to 3:30 P.M. Monday through Friday), the pay shall be straight time plus a ten percent (10%) differential.

(Bricklayers District Council)

TAPER

Drywall Taper

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $47.82
Supplemental Benefit Rate per Hour: $22.68

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Martin Luther King Jr. Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Thanksgiving Day
Christmas Day

Paid Holidays
Any worker who reports to work on Christmas Eve or New Year's Eve pursuant to his employer's instruction shall be entitled to three (3) hours afternoon pay without working.

(Local #1974)

TELECOMMUNICATION WORKER
(Voice Installation Only)

Telecommunication Worker

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $40.35
Supplemental Benefit Rate per Hour: $13.19
Supplemental Note: The above rate applies for Manhattan, Bronx, Brooklyn, Queens. $12.64 for Staten Island only.

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Time and one half the regular rate for Sunday.

Overtime Holidays
Time and one half the regular rate for work on the following holiday(s).
New Year's Day
Lincoln's Birthday
Washington's Birthday
Memorial Day
Independence Day
Labor Day
Columbus Day
Election Day
Veteran's Day
Thanksgiving Day
Christmas Day

Paid Holidays
New Year's Day
Lincoln's Birthday
Washington's Birthday
Memorial Day
Independence Day
Labor Day
Columbus Day
Election Day
Veteran's Day
Thanksgiving Day
Christmas Day
Employees have the option of observing either Martin Luther King's Birthday or the day after Thanksgiving instead of Lincoln's Birthday

Shift Rates

For any workday that starts before 8A.M. or ends after 6P.M. there is a 10% differential for the applicable worker's hourly rate.

Vacation

After 6 months.....one week.
After 12 months but less than 7 years.....two weeks.
After 7 or more but less than 15 years.....three weeks.
After 15 years or more but less than 25 years.....four weeks.

(C.W.A.)

TILE FINISHER

Tile Finisher

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $41.13
Supplemental Benefit Rate per Hour: $31.18

Overtime

Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays

Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Paid Holidays

None

Shift Rates

Off shift work day (work performed outside the regular 8:00 A.M. to 3:30 P.M. workday): shift differential of one and one quarter (1¼) times the regular straight time rate of pay for the seven hours of actual off-shift work.

Local #7)

TILE LAYER - SETTER

Tile Layer - Setter

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $53.19
Supplemental Benefit Rate per Hour: $35.35

Overtime
Time and one half the regular rate after a 7 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Good Friday
Memorial Day
Independence Day
Labor Day
Columbus Day
Veteran's Day
Thanksgiving Day
Day after Thanksgiving
Christmas Day

Shift Rates
Off shift work day (work performed outside the regular 8:00 A.M. to 3:30 P.M. workday): shift differential of one and one quarter (1¼) times the regular straight time rate of pay for the seven hours of actual off-shift work.

(Local #7)

TIMBERPERSON

Timberperson

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $48.00
Supplemental Benefit Rate per Hour: $49.16

Overtime
Time and one half the regular rate after an 8 hour day.
Time and one half the regular rate for Saturday.
Double time the regular rate for Sunday.
Saturday may be used as a make-up day at straight time when a day is lost during that week to inclement weather.
Time and one half the regular hourly rate after 40 hours in any work week.

Overtime Holidays
Double time the regular rate for work on the following holiday(s).
New Year's Day
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Presidential Election Day
Thanksgiving Day
Christmas Day

Paid Holidays
None

Shift Rates
Off shift work commencing between 5:00 P.M. and 11:00 P.M. shall work eight and one half hours allowing for one half hour for lunch. The wage rate shall be 113% of the straight time hourly wage rate.

(Local #1536)

TUNNEL WORKER

Blasters, Mucking Machine Operators (Compressed Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $62.37
Supplemental Benefit Rate per Hour: $52.39

Tunnel Workers (Compressed Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $60.21
Supplemental Benefit Rate per Hour: $50.65

Top Nipper (Compressed Air Rates)

Effective Period: 7/1/2017 - 6/30/2018

Wage Rate per Hour: $59.11
Supplemental Benefit Rate per Hour: $49.74

Outside Lock Tender, Outside Gauge Tender,Muck Lock Tender (Compressed Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $58.04
Supplemental Benefit Rate per Hour: $48.81

Bottom Bell & Top Bell Signal Person: Shaft Person (Compressed Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $58.04
Supplemental Benefit Rate per Hour: $48.81

Changehouse Attendant: Powder Watchperson (Compressed Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $50.87
Supplemental Benefit Rate per Hour: $46.11

Blasters (Free Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $59.52
Supplemental Benefit Rate per Hour: $50.03

Tunnel Workers (Free Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $56.97
Supplemental Benefit Rate per Hour: $47.89

All Others (Free Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $52.63
Supplemental Benefit Rate per Hour: $44.29

Microtunneling (Free Air Rates)

Effective Period: 7/1/2017 - 6/30/2018
Wage Rate per Hour: $45.58
Supplemental Benefit Rate per Hour: $38.31

Overtime Description

For Repair-Maintenance Work on Existing Equipment and Facilities - Time and one half the regular rate after a 7 hour day, or for Saturday, or for Sunday. Double time the regular rate for work on a holiday.
For Small-Bore Micro Tunneling Machines - Time and one-half the regular rate shall be paid for all overtime.

Overtime

Double time the regular rate after an 8 hour day.
Double time the regular time rate for Saturday.
Double time the regular rate for Sunday.
Double time the regular rate for work on the following holiday(s).

Paid Holidays

New Year's Day
Lincoln's Birthday
President's Day
Memorial Day
Independence Day
Labor Day
Columbus Day
Election Day
Veteran's Day
Thanksgiving Day
Christmas Day

(Local #147)

WELDER

TO BE PAID AT THE RATE OF THE JOURNEYPERSON IN THE TRADE PERFORMING THE WORK.

THIS PAGE INTENTIONALLY LEFT BLANK

NEW YORK CITY DEPARTMENT OF
DESIGN + CONSTRUCTION

Issue Date - June 01, 2013
Revised - January 15, 2015

DDC STANDARD GENERAL CONDITIONS

FOR SINGLE CONTRACT PROJECTS

Issue Date - June 01, 2013
Revised - January 15, 2015

NEW YORK CITY DEPARTMENT OF
DESIGN + CONSTRUCTION

DIVISION 01 – DDC STANDARD GENERAL CONDITIONS
SINGLE CONTRACT PROJECTS
TABLE OF CONTENTS

SECTION NO.	SECTION TITLE
01 10 00	SUMMARY
01 31 00	PROJECT MANAGEMENT AND COORDINATION
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
01 32 33	PHOTOGRAPHIC DOCUMENTATION
01 33 00	SUBMITTAL PROCEDURES
01 35 03	GENERAL MECHANICAL REQUIREMENTS
01 35 06	GENERAL ELECTRICAL REQUIREMENTS
01 35 26	SAFETY REQUIREMENTS PROCEDURES
01 35 91	HISTORIC TREATMENT PROCEDURES
01 40 00	QUALITY REQUIREMENTS
01 42 00	REFERENCES
01 50 00	TEMPORARY FACILITIES, SERVICES AND CONTROLS
01 54 11	TEMPORARY ELEVATORS AND HOISTS
01 54 23	TEMPORARY SCAFFOLDING AND PLATFORMS
01 73 00	EXECUTION
01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
01 77 00	CLOSEOUT PROCEDURES
01 78 39	CONTRACT RECORD DOCUMENTS
01 79 00	DEMONSTRATION AND OWNERS PRE-ACCEPTANCE ORIENTATION
01 81 13	SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS
01 81 13.13	VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS AND COATINGS FOR LEED BUILDINGS
01 81 19	INDOOR AIR QUALITY REQUIREMENTS FOR LEED BUILDINGS
01 91 13	GENERAL COMMISSIONING REQUIREMENTS

SECTION 01 10 00
SUMMARY

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

B. Addendum to the General Conditions: These General Conditions include and are supplemented by the Addendum to the General Conditions (the "Addendum"). The Addendum includes the following: (1) schedules referred to in these General Conditions (Schedule A through F), (2) information regarding the applicability of various articles, and (3) amended articles, if any.

1.2 SUMMARY:

A. This section includes the following:

1. Scope and Intent
2. Provisions Referenced in the Contract
3. Performance of Work During Non-Regular Work Hours (Pursuant to a Change Order)
4. Interruption of Services at Existing Facilities

1.3 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.4 SCOPE AND INTENT:

A. Description of Project: Refer to the Addendum for a description of the project.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 1.4 B

B. LEED: The City of New York will seek U.S. Green Building Council (USGBC) LEED (Leadership in Energy and Environmental Design) certification for this Project as specified in Section 01 81 13, "SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS" and the Addendum to the General Conditions.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 1.4 C

C. COMMISSIONING: The project will be commissioned by an independent third party under separate contract with the City of New York. Commissioning shall be in accordance with ASHRAE and USGBC LEED-NC procedures, as described in Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS, and the Addendum to the General Conditions. The Contractor shall cooperate with the commissioning agent and provide whatever assistance is required.

D. PROGRESS SCHEDULE: Refer to Section 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION for requirements of the project.

E. COMPLETION OF WORK: Work to be done under the Contract is comprised of the furnishing of all labor, materials, equipment and other appurtenances, and obtaining all regulatory agency approvals necessary and required to complete the construction work in accordance with the Contract.

F. OMISSION OF DETAILS: All work called for in the Specifications applicable to the Contract but not shown on the Contract Drawings in their present form, or vice versa, is required, and shall be performed by the Contractor as though it were originally delineated or described. The cost of such work shall be deemed included in the total Contract Price.

G. WORK NOT IN SPECIFICATIONS OR CONTRACT DRAWINGS: Work not particularly specified in the Specifications nor detailed on the Contract Drawings but involved in carrying out their intent or in the complete and proper execution of the work, is required, and shall be performed by the Contractor. The cost of such work shall be deemed included in the total Contract Price.

H. SILENCE OF THE SPECIFICATIONS: The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best practice is to prevail and that only the best material and workmanship is to be used and interpretation of the Specifications shall be made upon that basis.

I. CONFLICT BETWEEN CONTRACT DRAWINGS AND SPECIFICATIONS: Should any conflict occur in or between the Drawings and Specifications, the Contractor shall be deemed to have estimated the most expensive way of doing the work unless the Contractor shall have asked for and obtained a decision in writing from the Commissioner before the submission of the bid as to what shall govern.

1.5 CONTRACT DRAWINGS AND SPECIFICATIONS:

A. SCHEDULE C - The Contract Drawings are listed in Schedule C, which is set forth in the Addendum. Such drawings referred to in the Contract, and in the applicable Specifications for the Contract, bear the general title:

City of New York
Department of Design and Construction
Division of Public Buildings

B. DOCUMENTS FURNISHED TO THE CONTRACTOR - After the award of the Contract, the Contractor will be furnished with five (5) complete sets of paper prints of all Contract Drawings mentioned in Paragraph A above, as well as a copy of the Specifications.

C. ADDITIONAL COPIES of Drawings and Specifications, when requested, will be furnished to the Contractor if available.

D. SUPPLEMENTARY DRAWINGS - When, in the opinion of the Commissioner, it becomes necessary to more fully explain the work to be done, or to illustrate the work further, or to show any changes which may be required, drawings known as Supplementary Drawings will be prepared by the Commissioner.

E. COMPENSATION - Where Supplementary Drawings entail extra work, compensation therefore to the Contractor shall be subject to the terms of the Contract. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings.

F. SUPPLEMENTARY DRAWING PRINTS - Three (3) copies of prints of these Supplementary Drawings will be furnished to the Contractor.

G. COPIES TO SUBCONTRACTORS - The Contractor shall furnish each of its subcontractors and material suppliers such copies of Contract Drawings, Supplementary Drawings, or copies of the Specifications as may be required for its work.

1.6 COORDINATION:

A. COORDINATION AND COOPERATION - The Contractor shall consult and study the requirements of the Contract Drawings and Specifications for all required work, including all work to be performed by trade subcontractors, so that the Contractor may become acquainted with the work of the project as a whole in order to achieve the proper coordination and cooperation necessary for the efficient and timely performance of the work.

B. CONTRACTOR TO CHECK DRAWINGS: - The Contractor shall verify all dimensions, quantities and details shown on the Contract Drawings, Schedules, or other data received from the Commissioner, and shall notify the Commissioner of all errors, omissions, conflicts and discrepancies found therein. Notice of such errors shall be given before the Contractor proceeds with any work. Figures shall be used in preference to scale dimensions and large-scale drawings in preference to small-scale drawings.

1.7 SHOP DRAWINGS AND RECORD DRAWINGS:

Refer to Division I Section 01 33 00 – SUBMITAL PROCEDURES and Section 01 78 39 – PROJECT RECORD DRAWINGS for requirements applicable to shop drawings and record drawings.

1.8 TEMPORARY FACILITIES, SERVICES AND CONTROLS:

Refer to Division I Section 01 50 00 – TEMPORARY FACILITIES SERVICES AND CONTROLS for the responsibilities of the Contractor.

1.9 DUST CONTROL:

The Contractor shall prepare, execute and manage a "Dust Control Plan" for the prevention of the emission of dust from construction related activities in compliance with 15 RCNY 13-01 et. seq.

1.10 PROVISIONS REFERENCED IN THE CONTRACT:

A. SCHEDULE A - Various Articles of the Contract refer to requirements set forth in Schedule A of the General Conditions. Schedule A, which is included in the Addendum, sets forth (1) the referenced Articles of the Contract, and (2) the specific requirements applicable to the Contract.

B. EXTENSION OF TIME - Applications for Extensions of Time, as indicated in Article 13 of the Contract, shall be made in accordance with the Rules of the Procurement Policy Board.

C. PARTIAL PAYMENTS FOR MATERIALS IN ADVANCE OF THEIR INCORPORATION IN THE WORK PURSUANT TO ARTICLE 42 OF THE CONTRACT – In order to better insure the availability of materials, fixtures and equipment when needed for the work, the Commissioner may authorize partial payment for certain materials, fixtures and equipment, prior to their incorporation in the work, but only in strict accordance with, and subject to, all the terms and conditions set forth in the Specifications, unless an alternate method of payment is elsewhere provided in the Specifications for specified materials, fixtures or equipment.

1. The Contractor shall submit to the Commissioner a written request, in quadruplicate, for payment for materials purchased or to be purchased for which the Contractor needs to be paid prior to their actual incorporation in the work. The request shall be accompanied by a schedule of the types and quantities of materials, and shall state whether such materials are to be stored on or off the site.

2. Where the materials are to be stored off the site, they shall be stored at a place other than the Contractor's premises (except with the written consent of the Commissioner) and under the conditions prescribed or approved by the Commissioner. The Contractor shall set apart and separately store at the place or places of storage all materials and shall clearly mark same "PROPERTY OF THE CITY OF NEW YORK", and further, shall not at any time move any of said materials to another off-site place of storage without the prior written consent of the Commissioner. Materials may be removed from their place of storage off the site for incorporation in the work upon approval of the Resident Engineer.

3. Where the materials are to be stored at the site, they shall be stored at such locations as shall be designated by the Resident Engineer and only in such quantities as, in the opinion of the Resident Engineer, will not interfere with the proper performance of the work by the Contractor or by other Contractors then engaged in performing work on the site. Such materials shall not be removed from their place of storage on the site except for incorporation in the work, without the approval of the Resident Engineer.

4. INSURANCE

   a. STORAGE OFF-SITE – Where the materials are stored off the site and until such time as they are incorporated in the work, the Contractor shall fully insure such materials against any and all risks of destruction, damage or loss including but not limited to fire, theft, and any other casualty or happening. The policy of insurance shall be payable to the City of New York. It shall be in such terms and amounts as shall be approved by the Commissioner and shall be placed with a company duly licensed to do business in the State of New York. The Contractor shall deliver the original and one (1) copy of such policy or policies marked "Fully Paid" to the Commissioner.

   b. STORAGE ON THE SITE – Where the materials are stored at the site, the Contractor shall furnish satisfactory evidence to the Commissioner that they are properly insured against loss, by endorsements or otherwise, under the policy or policies of insurance obtained by the Contractor to cover losses to materials owned or installed by the Contractor. The policy of insurance shall cover fire and extended coverage against windstorm, hail, explosion and riot attending a strike, civil commotion, aircraft, vehicles and smoke.

5. All costs, charges and expenses arising out of the storage of such materials, shall be paid by the Contractor and the City hereby reserves the right to retain out of any partial or final payment made under the Contract an amount sufficient to cover such costs, charges and expenses with the understanding that the City shall have and may exercise any and all other remedies at law for the recovery of such cost, charges and expenses. There shall be no

increase in the Contract price for such costs, charges and expenses and the Contractor shall not make any claim or demand for compensation therefore.

6. The Contractor shall pay any and all costs of handling and delivery of materials, to the place of storage and from the place of storage to the site of the work; and the City shall have the right to retain from any partial or final payment an amount sufficient to cover the cost of such handling and delivery.

7. In the event that the whole or any part of these materials are lost, damaged or destroyed in advance of their satisfactory incorporation in the work, the Contractor, at the Contractor's own cost, shall replace such lost, damaged or destroyed materials of the same character and quality. The City will reimburse the Contractor for the cost of the replaced materials to the extent, and only to the extent, of the funds actually received by the City under the policies of insurance hereinbefore referred to. Until such time as the materials are replaced, the City will deduct from the value of the stored materials or from any other money due under the Contract, the amount paid to the Contractor for such lost, damaged or destroyed materials.

8. Should any of the materials paid for the City hereunder be subsequently rejected or incorporated in the work in a manner or by a method not in accordance with the Contract Documents, the Contractor shall remove and replace, at Contractor's own cost, such defective or improperly incorporated material with materials complying with the Contract Documents. Until such materials are replaced, the City will deduct from the value of the stored materials or from any other money due the Contractor, the amount paid by the City for such rejected or improperly incorporated materials.

9. Payments for the cost of materials made hereunder shall not be deemed to be an acceptance of such materials as being in accordance with the Contract Documents, and the Contractor always retains and must comply with the Contractor's duty to deliver to the site and properly incorporate in the work only materials which comply with the Contract Documents.

10. The Contractor shall retain any and all risks in connection with the damage, destruction or loss of the materials paid for hereunder to the time of delivery of the same to the site of the work and their proper incorporation in the work in accordance with the Contract Documents.

11. The Contractor shall comply with all laws and the regulations of any governmental body or agency pertaining to the priority purchase, allocation and use of the materials.

12. When requesting payment for such materials, the Contractor shall submit with the partial estimate duly authenticated documents of title, such as bills of sale, invoices or warehouse receipts, all in quadruplicate. The executed bills of sale shall transfer title to the materials from the Contractor to the City. (In the event that the invoices state that the material has been purchased by a subcontractor, bills of sale in quadruplicate will also be required transferring title to the materials from subcontractor to the Contractor).

13. Where the Contractor, with the approval of the Commissioner, has purchased unusually large quantities of materials in order to assure their availability for the work, the Commissioner, at the Commissioner's option, may waive the requirements of Paragraph 12 provided the Contractor furnishes evidence in the form of an affidavit from the Contractor in quadruplicate, and such other proof as the Commissioner may require, that the Contractor is the sole owner of such materials and has purchased them free and clear of all liens and other encumbrances. In such event, the Contractor shall pay for such materials and submit proof thereof, in the same manner as provided in Paragraph 12 hereof, within seven (7) days after receipt of payment therefore from the Comptroller. Failure on the part of the Contractor to submit satisfactory evidence that all such materials have been paid for in full, shall preclude the Contractor from payments under the Contract.

14. The Contractor shall include in each succeeding partial estimate requisition a summary of materials stored which shall set forth the quantity and value of materials in storage, on or off the site, at the end of each preceding estimate period; the amount removed for incorporation in the work; the quantity and value of materials delivered during the current period and the total value of materials on hand for which payment thereof will be included in the current payment estimate.

15. Upon proof to the satisfaction of the Commissioner of the actual cost of such materials and upon submission of proper proof of title as required under Paragraph 12 or Paragraph 13 hereof, payment will be made therefore to the extent of 85%, provided however, that the cost so verified, established and approved shall not exceed the estimated cost of such materials included in the approved detailed breakdown estimate submitted in accordance with Article 41 of the Contract; if it does, the City will pay only 85% approved estimated cost.

16. Upon the incorporation in the work of any such materials, which have been paid for in advance of such incorporation in accordance with the foregoing provisions, payment will be made for such materials incorporated in the work pursuant to Article 42 of the Contract, less any sums paid pursuant to Paragraph 15 herein.

D. MOBILIZATION PAYMENT – A line item for mobilization shall be allowed on the Contractor's Detailed Bid Breakdown submitted in accordance with Article 41 of the Contract. The Mobilization Payment is intended to include the cost of required bonds, insurance coverage and/or any other expenses required for the initiation of the Contract Work. All costs for mobilization shall be deemed included in the total Contract Price. The Detailed Bid Breakdown shall reflect, and the Mobilization Payment shall be made, in accordance with the following schedule:

Contract Amount		**Percent**		**Mobilization**
Less than - $ 50,000	x 0	=	0	
$ 50,000 - $ 100,000	x	=	$ 6,000	
$ 100,001 - $ 500,000	x 6	=	$ 6,000 (min)	- $ 30,000 (max)
$ 500,000 - $ 2,500,000	x 5	=	$ 30,000 (min)	- $ 125,000 (max)
Over - $ 2,500,000	x 4	=	$ 125,000 (min)	- $ 300,000 (max)

The Contractor may requisition for one-half (1/2) of the Mobilization Payment upon satisfactory completion of the following:

1. Installation of any required field office(s).
2. Submission of all required insurance certificates and bonds.
3. Approval by the Department of Design and Construction of the coordinated progress schedule for the project and the Contractor's Shop Drawing schedule.

The remaining balance of the Mobilization Payment may be requisitioned only after 10 percent (10%) of the Contract price, exclusive of the total amount of Mobilization Payments made or to be made hereunder, shall have been approved for payment.

E. ULTRA LOW SULFUR DIESEL FUEL AND BEST AVAILABLE TECHNOLOGY REPORTING: The Contractor shall submit reports to the Commissioner regarding the use of Ultra Low Sulfur Diesel Fuel in Non-Road Vehicles, and the implementation of Best Available Technology (BAT), as set forth in Article 5.4 of the Contract. Such reports shall be submitted in accordance with the schedule, format, directions and procedures established by the Commissioner.

1.11 PERFORMANCE OF WORK DURING NON-REGULAR WORK HOURS:

A. NON-REGULAR WORK HOURS: The Commissioner may issue a change order in accordance with Article 25 of the Contract which (1) directs the Contractor to perform the Work, or specific components thereof, during other than regular work hours (i.e., evenings, weekends and holidays), and (2) provides compensation to the Contractor for costs in connection with the performance of Work during other than regular work hours. The Commissioner may issue a change order if a delay has occurred and such delay is not the fault of the Contractor, or if the work is of such an important nature that delay in completing such work would result in serious disadvantage to the public.

B. PROCEDURE: The Contractor shall (1) obtain whatever permits may be required for performance of the work during other than regular business hours, and (2) pay all necessary fees in connection with such permits. In addition, if directed by the Commissioner, the Contractor shall make immediate application to the Commissioner of the Department of Labor, State of New York, for dispensation in accordance with Subdivision 2 of Section 220 of the Labor Law.

1.12 INTERRUPTION OF SERVICES AT EXISTING FACILITIES:

A. EVENING AND WEEKEND WORK - Where performance of the Work requires the temporary shutdown(s) of services, such shutdown(s) shall be made at night or on weekends or at such times that will cause no interference with the established routines and operations of the facility in question.

1 Where weekend or evening work is required due to unavoidable service shutdowns, such work shall be performed at no extra cost to the City. Components of the Work that must be performed during other than regular work hours are indicated in the Drawings and/or the Specifications.

B. INTERRUPTION OF EXISTING FACILITIES:

1 The Contractor shall not interrupt any of the services of the facility nor interfere with such services in any way without the permission of the Commissioner. Such interruption or interferences shall be made as brief as possible, and only at such time stated.

2 Under no circumstances shall the Contractor, its subcontractors, or its workers, be permitted to use any part of the project as a shop, without the permission of the Commissioner.

3 Unnecessary noise shall be avoided at all times and necessary noise shall be reduced to a minimum.

4 Toilet facilities, water and electricity must be operational at all times (i.e. 24/7). No services of the facility can be interrupted in any way without the permission of the Commissioner. Careful coordination of all work with the Resident Engineer must be done to maintain the operational level of the project personnel at the facility.

5 The Contractor shall schedule the work to avoid noise interference that will affect the normal functions of the facility. In particular, construction operations producing noises that are objectionable to the functions of the facility must be scheduled at times of day or night, day of the week, or weekend, which will not interfere with personnel at the facility. Any additional cost resulting from this scheduling shall be borne by the Contractor.

6 The Contractor shall arrange to work continuously, including evening and weekend hours, if required, to assure that services will be shut down only during the time actually required to make the necessary connections to the existing facility.

7 The Contractor shall give ample written notice in advance to the Commissioner and personnel at the facility of any required shutdown.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

B. LEED: Refer to the Addendum to identify whether this project is designed to comply with a Certification Level according to the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Rating System, as specified in Section 01 81 13, "SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS."

C. COMMISSIONING: Refer to the Addendum to identify whether this project will be commissioned by an independent third party under separate contract with the City of New York. Commissioning shall be in accordance with ASHRAE and USGBC LEED-NC procedures, as described in Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS. The Contractor shall cooperate with the commissioning agent and provide whatever assistance is required.

1.2 SUMMARY:

A. This Section includes administrative provisions for coordinating construction operations on the Project including without limitation the following.

1. Coordination Drawings.
2. Administrative and supervisory personnel.
3. Project meetings.
4. Requests for Interpretation (RFIs).

B. This section includes the following:

1. Definitions
2. Coordination
3. Submittals
4. Administrative and Supervisory Personnel
5. Project Meetings
6. Requests for Interpretation (RFI's)
7. Correspondence
8. Contractor's Daily Reports
9. Alternate and Substitute Equipment

C. RELATED SECTIONS: include without limitation the following:

1. Section 01 10 00 SUMMARY
2. Section 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION
3. Section 01 33 00 SUBMITTALS
4. Section 01 35 26 SAFETY REQUIREMENTS
5. Section 01 73 00 EXECUTION REQUIREMENTS
6. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

7. Section 01 77 00 PROJECT CLOSEOUT PROCEDURES

1.3 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.4 COORDINATION:

A. Coordination: The Contractor shall coordinate its construction operations, including those of its subcontractors, with other entities to ensure the efficient and orderly installation of each part of the Work. The Contractor shall coordinate the various operations required by different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence in order to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. The Contractor shall prepare memoranda for distribution to its subcontractors and other involved entities, outlining special procedures required for coordination. Such memoranda shall include required notices, reports, and meeting minutes as applicable.

C. Administrative Procedures: The Contractor shall coordinate scheduling and timing of required administrative procedures with other construction activities and activities of its subcontractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include without limitation the following:

1. Preparation of Contractor's Construction Schedule.
2. Installation and removal of temporary facilities and controls.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Pre-installation conferences..
6. Startup and adjustment of systems.
7. Project closeout activities.

D. Conservation: The Contractor shall coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

E. Salvaged Items, Material and/or Equipment: The Specifications may identify certain items, materials or equipment which must be salvaged by the Contractor and handled or disposed of as directed. The Contractor shall comply with all directions in the Specifications regarding the salvaging and handling of identified items, material or equipment.

1.5 SUBMITTALS:

A. Submit shop drawings, product data, samples etc. in compliance with Section 01 33 00, SUBMITTAL PROCEDURES.

B. Coordination Drawings: The Contractor shall prepare applicable Coordination Drawings in compliance with the requirements for Coordination Drawings in Section 01 33 00, SUBMITTAL PROCEDURES.

C. Safety Plan in compliance with Section 01 35 26, SAFETY REQUIREMENTS PROCEDURES.

D. Waste Management Plan in compliance with Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

E. Key Personnel Names: Within 15 days after the Notice to Proceed, the Contractor shall submit a list of key personnel assignments of the Contractor and its subcontractors, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in case of the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

2. In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work. Include special personnel required for coordinating all operations by its subcontractors.

1.6 PROJECT MEETINGS:

A. General: The Resident Engineer will hold regularly scheduled construction progress meetings at the site, at which time the Contractor and appropriate subcontractors shall have their representatives present to discuss all details relative to the execution of the work. The Resident Engineer shall preside over these meetings.

1. Agenda: Prior to each meeting, the Resident Engineer will consult with the Contractors and will prepare an agenda of items to be discussed. In general, after informal discussion of any item on the agenda, the Resident Engineer will summarize the discussion in a brief written statement, and the Contractor will then dictate a brief statement for the record.

2. Coordination: In addition to construction progress meetings called by the Resident Engineer, the Contractor shall hold regularly scheduled meetings for the purpose of coordinating; expediting and scheduling the work in accordance with the master coordinated Job Progress Chart. The Contractor and its subcontractors, material suppliers or vendors whose presence is necessary, are required to attend. These meetings may, at the discretion of the Contractor, be held at the same place and immediately following the project meetings held by the Resident Engineer. Minutes of these meetings shall be recorded, typed and printed by the Contractor and distributed to all parties concerned.

B. PRECONSTRUCTION KICK-OFF MEETING:

1. The Resident Engineer will schedule a preconstruction kick-off meeting either at DDC's main office or at the Project site to review responsibilities and personnel assignments and clarify the

role of each participant. Unless otherwise directed the Design Consultant will record and distribute meeting minutes.

2. Attendees: Authorized representative of the Client Agency; Design Consultant; the Contractor and its superintendents, subcontractor(s) and their superintendent(s); LEED sub-consultant and Commissioning Authority /Agent (CxA) as applicable and other concerned parties. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Contract Work.
3. Agenda: Includes without limitation the following as applicable:
   a. Establishing construction schedule
   b. Schedule for regular construction meetings
   c. Phasing
   d. Critical work sequencing and long-lead items
   e. Designation of key personnel and their duties
   f. Reviewing Application for Payment and Change Order Procedures
   g. Procedures for Requests for Information (RFIs.)
   h. Review Permits and Approval requirements
   i. Review all recent Administrative Code reporting requirements relating to the project, (i.e. LL 77, LL86 etc.)
   j. Procedures for testing and inspecting
   k. Reviewing special conditions at the Project site
   l. Distribution of the Contract Documents
   m. Submittal procedures
   n. Safety Procedures
   o. LEED requirements
   p. Commissioning Requirements
   q. Preparation of Record Documents
   r. Historic Treatment requirements
   s. Use of the premises
   t. Work restrictions
   u. Client Agency occupancy requirements
   v. Responsibility for temporary facilities, services and controls
   w. Construction Waste Management and Disposal
   x. Indoor Air Quality Management Plan
   y. Dust Mitigation Plan
   z. Office, work, and storage areas
   aa. Equipment deliveries and priorities
   bb. Security
   cc. Progress cleaning
   dd. Working hours

C. CONSTRUCTION PROGRESS MEETINGS:

1. The Resident Engineer will schedule and conduct construction progress meetings at bi-weekly intervals or as otherwise determined. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work. Unless otherwise directed the Design Consultant will record and distribute meeting minutes.
2. Attendees:
   a. Design Consultant and applicable sub-consultants
   b. Client Agency Representative
   c. Representatives from the Contractor, sub-contractor(s), suppliers or other entities involved in the current progress, planning, coordination or future activities of the Work
   d. Other appropriate DDC personnel, DDC consultants and concerned parties
3. Agenda: Includes without limitation the following:
   a. Review the Construction Schedule and progress of the Work. Determine if the Work is on time, ahead of schedule or behind schedule. Determine actions to be taken to maintain or accelerate the schedule
   b. Review and approve prior meeting minutes and follow up open issues
   c. Coordinate work between each subcontractor
   d. Sequence of Operations
   e. Status of submittals, deliveries and off-site fabrication
   f. Status of inspections and approvals by governing agencies
   g. Temporary facilities and controls
   h. Review Site Safety
   i. Quality and work standards
   j. Field observations
   k. Status of correction of deficient items
   l. RFI's
   m. Pending changes
   n. Status of outstanding Payments and Change Orders
   o. LEED requirements including Construction Waste Management, Indoor Air Quality Plan, Dust Mitigation and Commissioning
   p. Status of Administrative Code reporting requirements related to the project

1.7 REQUESTS FOR INFORMATION (RFI):

A. Procedure: Immediately on discovery of the need for information or interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, the Contractor shall prepare and submit an RFI in the form specified by the Resident Engineer.

1. RFI shall originate with the Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFI in a prompt manner to the Resident Engineer so as to avoid delays in Contractor's work or work of its subcontractors.
3. RFI Log: The Contractor shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number monthly to the Resident Engineer.

4. On receipt of responses and action to the RFI, the Contractor shall update the RFI log and immediately distribute the RFI response to affected parties. Review response(s) and notify the Resident Engineer immediately if the Contractor disagrees with response(s).

1.8 CORRESPONDENCE:

Copies of all correspondence to DDC shall be sent directly to the Resident Engineer at the job site.

1.9 CONTRACTOR'S DAILY REPORTS:

The Contractor shall prepare and submit Daily Construction Progress Reports as outlined in Section 01 32 00, CONSTRUCTION PROGRESS DOCUMENTATION.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for establishing an effective base line schedule for the project and documenting the progress of construction during performance of the Work by developing, revising as necessary, various documents including but not limited to the following:

1. Baseline Construction Schedule.
2. Composite Schedule for entire project
3. Recovery Composite Schedule
4. Revised and/or updated Composite Schedule
5. Submittals Schedule.
6. Daily construction reports.
7. Material location reports.
8. Field condition reports.
9. Special reports.

B. RELATED SECTIONS: include without limitation the following:

1. Section 01 10 00 SUMMARY
2. Section 01 32 22 PHOTOGRAPHIC DOCUMENTATION
3. Section 01 33 00 SUBMITTAL PROCEDURES
4. Section 01 40 00 QUALITY REQUIREMENTS

1.3 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Baseline Construction Schedule:
A horizontal bar chart type schedule (Microsoft Project OR similar program) listing all the activities and their duration for entire contract duration OR construction period, including logical ties and interrelations between the activities necessary for the timely and successful completion of the project. Critical path activities shall be clearly marked. The Baseline construction schedule is a preliminary schedule that must be reviewed and approved by the Resident Engineer.

D. Composite Schedule:
A composite horizontal bar chart type schedule (Microsoft Project OR similar program) listing all activities to be performed by the Contractor and its subcontractors, the duration of each activity including logical ties and interrelations between activities, and the sequence of each of necessary activities for the timely and successful completion of the project within the stipulated contract duration. Critical path activities shall be clearly marked. The Composite schedule must be signed and submitted by the Contractor within thirty (30) calendar days after the date established for commencement of the Contract, unless otherwise directed. The Composite Schedule must be reviewed and approved by the Resident Engineer.

E. Recovery Composite Schedule: A Recovery Composite Schedule is not required unless the City issues an Acceleration Change Order.

A Composite Schedule outlining and incorporating extraordinary efforts required to recover lost time with the aim of achieving completion of the project within the stipulated contract duration, plus authorized time extensions. In such case special attention must be given to keep the delays as minimum as possible and must establish the nature of efforts such as extended hours of work, weekend work, accelerated fabrication, required action(s) or effort(s) by the Contractor, its subcontractors, consultants, clients, end users and/or other concerned parties.

Such schedule must be prepared and submitted within Five (5) calendar days of request by the Resident Engineer. The Recovery Composite Schedule must be reviewed and approved by the Resident Engineer.

F. Revised and/or Updated Composite Schedule:

A Baseline construction schedule OR Composite Schedule OR Recovery Composite Schedule for the project that shows the actual duration of all the completed activities, including duration of and the reasons for delays, if any has occurred, AND revisions to all remaining activities of the Contractor and its subcontractors, including changes, if any, to logical ties, interrelations and the sequence of each of the outlined activities. Any such revisions should be shown on the row just below the approved schedule of the respective activity so that revisions can be compared.

The Revised and/or updated Composite Schedule must be reviewed and approved by the Resident Engineer.

G. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

H. Event: The starting or ending point of an activity.

I. Fragment: A part of the activity that breaks down activities into smaller activities for greater detail.

J. Milestone: A key or critical point in time for reference or measurement.

K. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

PART II – PRODUCTS

2.1 BASELINE CONSTRUCTION SCHEDULE:

A. The Contractor shall prepare a Baseline horizontal bar-chart-type construction schedule for the project. Submit the Baseline Construction Schedule to the Resident Engineer within (15) fifteen calendar days after the date established for commencement of the Contract, unless directed otherwise. The Baseline Schedule must be reviewed and approved by the Resident Engineer.

1. Provide a separate time bar for each significant construction activity. Coordinate each activity on the schedule with other construction activities for proper interrelationship & sequence.
2. Duration: The duration of each activity on the schedule besides installation must clearly show required duration of filing for permits, inspections, testing, approvals, shop drawings and materials submittals and approvals, fabrication, delivery, phasing for each construction activity.
3. Schedule shall be time-scaled in not more than weekly increments, with the dates of the first day (Monday) of each week indicated.
4. Completion of all the project activities shall be indicated in advance of the date established for completion of the Contract, allowing time for required inspection and punch list work.
5. Clearly show time bar for all the tasks, to be completed before start of physical work of scheduled activities, including but not limited to obtaining required permit, subcontractor approval, submission and approval of shop drawings, field verification, time for fabrication and delivery, testing of materials and/or samples, preparation and approval of mock-up sample, curing, pre-testing of soil, pre-testing of equipment - including start up, testing & adjusting, filing for inspection by regulatory agencies, training, final use, etc. required to maintain orderly progress of the activity. A special consideration must be given to those activities requiring early approvals because of long lead-time for manufacture or fabrication.
6. Phasing: Arrange all activities in proper sequence to reflect requirements for phased completion, work by other entities, work by the City, City furnished items, coordination with existing work, limitations arising due to continued occupancies, non-interruptible services, partial completion for occupancy, site restrictions, provisions for future work, seasonal variations, environmental control, and similar conditions of the project.
7. Arrange all activities and/or show interrelationship and logical sequence of all activities, determine and mark all critical path activities including any phasing reflecting actual project condition.
8. Keep at least two blank horizontal bars between all activities for recording actual progress and submitting Revised Schedule as defined in Sub-Section 1.3 G
9. If necessary a new revised schedule shall be prepared in the same manner as outlined above.

2.2 COMPOSITE SCHEDULE FOR THE PROJECT:

A. The Contractor shall prepare a Composite Schedule based on the approved Baseline Schedule Such schedule shall indicate graphically and chronologically the start and completion of each and every activity, including all the pre-activity and post activity tasks. Keep at least two blank horizontal bars between all activities for recording actual progress and/or revisions.

1. If necessary the Contractors shall meet with each subcontractor and with the Resident Engineer to review and make warranted adjustments and finalize the Composite Schedule. Once the schedule is finalized, the Contractor shall sign and date a reproducible form of the Composite Schedule. The Composite Schedule must be finalized and signed by the Contractor within (30) thirty calendar days after the date established for commencement of the Contract, unless directed otherwise. The Composite Schedule must be reviewed and approved by the Resident Engineer.

2.3 RECOVERY COMPOSITE SCHEDULE:

A. A Recovery Composite Schedule is not required unless the City issues an Acceleration Change Order. A Recovery Composite Schedule outlining and incorporating extraordinary efforts required to recover lost time with the aim of achieving completion of the project within the stipulated contract duration, plus authorized time extensions, must be developed and submitted within (5) five calendar days of the request by the Resident Engineer. Such Recovery Composite Schedule shall include all information as defined in Article 1.3 F and shall be prepared in the same manner as outlined in Sub-Sections 2.1 and 2.2. The Recovery Composite Schedule must be reviewed and approved by the Resident Engineer.

2.4 REVISED AND/OR UPDATED COMPOSITE SCHEDULE:

A. The Contractor shall revise and/or update the approved Composite Schedule as directed. The Revised schedule shall be prepared in the same manner as outlined above in Sub-Sections 2.1 and 2.2.

B. The Contractor shall mark actual progress, delays, work stoppage etc. in the row just below the approved schedule for the respective activity so that revisions can be compared.

C. Such schedule also shall indicate graphically and chronologically any revisions to the start and completion of the remaining activities including revisions to all the pre-activity and post activity tasks for all subcontractors.

D. If necessary, the Contractor shall meet with each subcontractor and with the Resident Engineer to review and make warranted adjustments and finalize the Revised Composite Schedule. Once the schedule is finalized, the Contractor shall sign and date a reproducible form of the Schedule. Such schedule must be prepared and submitted by the Contractor within Five (5) calendar days of request by the Resident Engineer. The Revised Composite Schedule must be reviewed and approved by the Resident Engineer.

2.5 SUBMITTALS SCHEDULE:

A. Preparation: The Contractor shall submit a schedule of submittals, arranged in chronological order by dates required by the construction schedule. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

B. SCHEDULE F: Schedule F sets forth all submittal requirements for shop drawings and material samples. Schedule F is included in the Addendum. At the kick-off meeting, the Contractor must review this Schedule with the Resident Engineer and the Design Consultant. Within 10 days after the kick-off meeting, the Contractor must complete information on Schedule F concerning the submission date, the required delivery date and the fabrication time. For all required submittals of shop drawings and material samples, the Schedule F provided by the Contractor must indicate a submission date which is at least 20 business days prior to the date of the manufacture of the item or materials to be installed. In addition, if so directed by the Commissioner, the Schedule F provided by the Contractor must indicate a submission date for shop drawings and/or material samples of specified items or materials which is within 60 business days after the kick-off meeting. In the event of any conflict between the Specifications and Schedule F, Schedule F shall take precedence; provided, however, in the event of an omission from Schedule F (i.e., Schedule F omits either a reference to or information concerning a submittal requirement which is set forth in the Specifications), such omission from Schedule F shall have no effect and the Contractor's submittal obligation, as set forth in the Specifications, shall remain in full force and effect.

C. Review: The Resident Engineer will review the Schedule F submitted by Contractor. Upon acceptance, the Resident Engineer will date and sign the schedule as approved and transmit it to the Consultant, Contractor and others within DDC as he/she deems appropriate.

2.6 REPORTS:

A. Daily Construction Reports: The Contractor shall submit to the Resident Engineer written Daily Construction Reports at the end of each work day, recording basic information such as the date, day, weather conditions, and contract days passed, remaining contract duration/days and the following information concerning the Project.

Information: The reports shall be prepared by the Contractor's Superintendent and shall bear the Contractor's Superintendents signature. Each report shall contain the following information:

1. List of name of Contractor, subcontractors, their work force in each category, and details of activities performed.
2. The type of materials and/or major equipment being installed by the Contractor and/or by each subcontractor.
3. The major construction equipment being used by the Contractor and/or subcontractors.
4. Material and Equipment deliveries.
5. High and low temperatures and general weather conditions.
6. Accidents.
7. Meetings and significant decisions.
8. Unusual events.
9. Stoppages, delays, shortages, and losses.
10. Meter readings and similar recordings
11. Emergency procedures.
12. Orders and/or requests of authorities having jurisdiction.
13. Approved Change Orders received and implemented.
14. Field Orders and Directives received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial Completions and occupancies.
18. Substantial Completions authorized.

NOTE: If there is NO ACTIVITY at site, a daily report indicating so and the reason for no activity at the site must be submitted.

B. Material Location Reports: The contractor shall submit a Material Location Report at weekly OR monthly intervals as determined and established by the Resident Engineer. Such report shall include a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit a Request For Information (RFI) form with a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.7 SPECIAL REPORTS:

A. Accident report, incident report, special condition report for the conditions out of control of any party involved with the project effecting project progress, explaining impact on the project schedule and cost if any.

PART III – EXECUTION (Not Used)
END OF SECTION 01 32 00

SECTION 01 32 33
PHOTOGRAPHIC DOCUMENTATION

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SECTION 01 32 33

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract]

1.2 SUMMARY:

A. This Section includes the following:
1. Photographic Media
2. Construction Photographs
3. Pre-construction Photographs
4. Periodic Construction Progress Photographs
5. Special Photographs
6. DVD Recordings
7. Final Completion Construction Photographs

B. RELATED SECTIONS: include without limitation the following:

1.	Section 01 10 00	SUMMARY
2.	Section 01 33 00	SUBMITTAL PROCEDURES
3.	Section 01 35 91	HISTORIC TREATMENT PROCEDURES
4.	Section 01 78 39	CONTRACT RECORD DOCUMENTS
5.	Section 01 81 19	INDOOR AIR QUALITY REQUIREMENTS FOR LEED BUILDINGS

C. PHOTOGRAPHER - The Contractor shall employ and pay for the services of a professional photographer who shall take photographs showing the progress of the work for all Contracts.

1.3 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.4 SUBMITTALS:

A. Qualification Data: For photographer.

B. Key Plan: With each Progress Photograph Submittal include a key plan of Project site and building with notation of vantage points marked for location and direction of each image. Indicate location, elevation or story of construction. Include same label information as corresponding set of photographs.

C. Construction Progress Photograph Prints: Take Progress Photographs bi-weekly and submit four color prints of each photographic view for each trade to the Resident Engineer. Such photographs shall be included in each monthly progress report or as otherwise directed by the Resident Engineer.

D. Construction Photograph Negatives: Submit a complete set of photographic negatives in individually protected negative sleeves with each submittal of prints. Identify negatives with label matching photographic prints.

E. Digital Images: If Digital Media is used, submit a complete set of digital color image electronic files on CD-ROM with each submittal of prints. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, un-cropped.

1.5 QUALITY ASSURANCE:

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.6 COORDINATION:

A. The Contractor and its subcontractor(s) shall cooperate with the photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.7 COPYRIGHT:

A. The Contractor shall include the provisions set forth below in the agreement between the Contractor and the Photographer who will provide the construction photographs described in this section. The Contractor shall submit to the Resident Engineer a copy of its agreement with the Photographer.

B. Any photographs, images and/or other materials produced pursuant to this Agreement, and any and all drafts and/or other preliminary materials in any format related to such items produced pursuant to this Agreement, shall upon their creation become the exclusive property of the City.

C. Any photographs, images and/or other materials provided pursuant to this Agreement ("Copyrightable Materials") shall be considered "work-made-for-hire" within the meaning and purview of Section 101 of the United States Copyright Act, 17 U.S.C. § 101, and the City shall be the copyright owner thereof and of all aspects, elements and components thereof in which copyright protection might exist. To the extent that the Copyrightable Materials do not qualify as "work-made-for-hire," the Photographer hereby irrevocably transfers, assigns and conveys exclusive copyright ownership in and to the Copyrightable Materials to the City, free and clear of any liens, claims, or other encumbrances. The Photographer shall retain no copyright or intellectual property interest in the Copyrightable Materials. The Copyrightable Materials shall be used by the Photographer for no purpose other than in the performance of this Agreement without the prior written permission of the City. The Department may grant the Photographer a license to use the Copyrightable Materials on such terms as determined by the Department and set forth in the license.

D. The Photographer acknowledges that the City may, in its sole discretion, register copyright in the Copyrightable Materials with the United States Copyright Office or any other government agency authorized to grant copyright registrations. The Photographer shall fully cooperate in this effort, and agrees to provide any and all documentation necessary to accomplish this.

E. The Photographer represents and warrants that the Copyrightable Materials: (i) are wholly original material not published elsewhere (except for material that is in the public domain); (ii) do not violate any copyright Law; (iii) do not constitute defamation or invasion of the right of privacy or publicity; and (iv) are not an infringement, of any kind, of the rights of any third party. To the extent that the Copyrightable Materials incorporate any non-original material, the Photographer has obtained all necessary permissions and clearances, in writing, for the use of such non-original material under this Agreement, copies of which shall be provided to the City.

PART II – PRODUCTS

2.1 PHOTOGRAPHIC MEDIA:

A. Photographic Film: Medium format, 2-1/4 by 2-1/4 inches (60 by 60 mm).

B. Digital Images:

1. Construction Progress Images: Color images in JPEG format with minimum sensor size of 1.3 megapixels.

2. Presentation Quality Images: Provide Color images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 with 8"x10" original capture at 300 dpi or greater.

C. Prints:

1. Format: 8-by-10-inch (203-by-254-mm) smooth-surface matte color prints on single-weight commercial-grade stock paper, with 1inch wide margins and punched for standard 3-ring binder.

2. Identification: On the front of each photograph affix a label in the margin with Project name and date photograph was taken. On the back of each print, provide an applied label or rubber-stamped impression with the following information:
   a. Project Contract I.D. Number.
   b. Project Contract Name.
   c. Name of Contractor. (and Subcontractor Trade Represented)
   d. Subject of Image Taken.
   e. Date and time photograph was taken if not date stamped by camera.
   f. Description of vantage point, indicating location, direction and other pertinent information.
   g. Unique sequential identifier.
   h. Name and address of photographer.

PART III – EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS:

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location and direction of view.

B. Film Images:

1. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

2. Field Office Prints: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs same as for those submitted to Commissioner.

C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in filename for each image.

2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Commissioner.

3.2 PRE-CONSTRUCTION & PRE-DEMOLITION PHOTOGRAPHS:

A. Before commencement of Contract work at the site, take color photographs of Project site and surrounding properties, including existing structures or items to remain during construction, from different vantage points, as directed by the Resident Engineer.

1. Flag applicable excavation areas and construction limits before taking construction photographs.

2. Take photographs of minimum eight (8) views to show existing conditions adjacent to property before starting the Work.

3. Take applicable photographs of minimum eight (8) views of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

4. Take additional photographs as required or directed by the Resident Engineer to record settlement or cracking of adjacent structures, pavements, and improvements.

B. Demolition Operations: Take photographs as directed by the Resident Engineer of minimum of eight (8) views each before commencement of demolition operations, at mid-point of operations and at completion of operations.

C. Pre-Demolition Photographs: Take archival quality color photographs, to include all exterior building facades, of all structures at the Project site designated to be fully demolished or removed in compliance with NYC Building Code requirements. Submit four (4) complete sets of pre-demolition photographs, in the format specified herein, to the Resident Engineer for submission to the Department of Buildings.

3.3 PERIODIC CONSTRUCTION PROGRESS PHOTOGRAPHS:

A. Take photographs of minimum eight (8) views bi-weekly as directed by the Resident Engineer of construction progress for each contract trade. Select vantage points to show status of construction and progress since last photographs were taken.

3.4 SPECIAL PHOTOGRAPHS:

A. The photographer shall take special photographs of subject matter or events as specified in other sections of the Project Specifications from vantage points specified or as otherwise directed by the Resident Engineer.

B. Historical Elements: As required in Section 01 35 91, HISTORIC TREATMENT PROCEDURES, for Contract work at designated landmark structures or sites the photographer, as specified and required by individual sections of the Contract documents or at the direction of the Commissioner, shall take images of existing elements scheduled to be removed for replacement, repair or replication in quantities as directed, including post-construction photographs of completed work as directed by the Commissioner.

1. Take Presentation Quality Photographs of designated landmark structures as directed by the Commissioner for submission to the New York City Landmarks Preservation Commission. Provide a minimum of four color photographic prints of each view as directed.

3.5 DVD RECORDING:

A. When DVD Recording of Demonstration and Training sessions is required for Non-Commissioned projects the Contractor shall provide the services of a Videographer as indicated in Section 01 79 00, DEMONSTRATION AND OWNER'S PRE-ACCEPTANCE ORIENTATION.

3.6 FINAL COMPLETION CONSTRUCTION PHOTOGRAPHS:

A. Take color photographs of minimum eight (8) unobstructed views of the completed project or project and site, as directed by the Commissioner and after all scaffolding, hoists, shanties, field offices or other temporary work has been removed and final cleaning is done after date of Substantial Completion for submission as Project Record Documents. Submit four (4) sets of each view of Presentation Quality photographic prints including negatives and/or digital images electronic file.

END OF SECTION 01 32 33

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART I – GENERAL:

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Coordination Drawings, Catalogue Cuts, Material Samples and other submittals required by the Contract Documents.

B. Review of submittals does not relieve the Contractor of responsibility for any Contractor's errors or omissions in such submittals, nor from responsibility for complying with the requirements of the Contract.

C. Responsibility of the Contractor: The approval of Shop Drawings will be general and shall not relieve the Contractor of responsibility for the accuracy of such Shop Drawings, nor for the proper fitting and construction of the work, nor of the furnishing of materials or work required by the Contract and not indicated on the Shop Drawings. Approval of Shop Drawings shall not be construed as approving departures from the Contract Drawings, Supplementary Drawings or Specifications.

D. This Section includes the following:
1. Definitions
2. Submission Procedures
3. Coordination Drawings
4. LEED Submittals
5. Ultra Low Sulfur Diesel Fuel Reporting
6. Construction Photographs and DVD Recordings
7. As-Built Documents

1.3 RELATED SECTIONS: Include without limitation the following:

A.	Section 01 10 00	SUMMARY
B.	Section 01 31 00	PROJECT MANAGEMENT AND COORDINATION
C.	Section 01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
D.	Section 01 32 33	PHOTOGRAPHIC DOCUMENTATION
E.	Section 01 77 00	CLOSEOUT PROCEDURES
F.	Section 01 78 39	CONTRACT RECORD DOCUMENTS
G.	Section 01 81 13	SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or

combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Submittals: Written and graphic information that requires responsive actions and includes without limitation all shop drawings, product data, letters of certification, tests and other information required for quality control and as required by the Contract Documents.

D. Informational Submittals: Written information that does not require responsive action. Submittals may be rejected for non-compliance with the Contract.

E. Shop Drawings: Include drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, except for coordination drawings, specifically prepared for the project by the Contractor or any subcontractor, manufacturer, supplier or distributor, which illustrates how specific portions of the work shall be fabricated and/or installed.

F. Coordination Drawings: As required in Section 01 31 00 PROJECT MANAGEMENT AND COORDINATION.

G. Product Data and Quality Assurance Submittals: Includes manufacturer's standard catalogs, pamphlets and other printed materials including without limitation the following:

1. Catalogue and Product specifications
2. Installation instructions
3. Color charts
4. Catalog cuts
5. Rough-in diagrams and templates
6. Wiring diagrams
7. Performance curves
8. Operational range diagrams
9. Mill reports
10. Design data and calculations
11. Certification of compliance or conformance
12. Manufacturer's instructions and field reports

1.5 COORDINATION DRAWINGS:

A. The Contractor shall provide reproducible Coordination Drawing(s) of the reflective ceiling showing the integration of all applicable contract work, including general construction work as well as trade work (Plumbing, HVAC, and Electrical) to be performed by subcontractors. The Coordination Drawing(s) shall include, without limitation, the following information:
   1. General Construction work showing the reflective ceiling plan including starting points, ceiling and beam soffits elevations, ceiling heights, roof openings, etc.
   2. HVAC Contract work showing ductwork, heating and sprinkler piping, location of grilles, registers etc. and access doors in hung ceilings. Locations shall be fixed by elevations and dimensions from column centerlines and/or walls.
   3. Plumbing Contract work including piping, valves, cleanouts etc., indicating locations and elevations and shall indicate the necessary access doors.
   4. Electrical Contract work indicating fixtures, large conduit runs, clearances, pull boxes, junction boxes, sound system speakers, etc.

B. The Contractor shall issue the completed Coordination Drawing(s) to the Resident Engineer for his/her review. The Resident Engineer may call as many meetings as necessary with the Contractor, including

attendance by applicable subcontractors, and may call on the services of the Design Consulting where necessary, to resolve any conflicts that become apparent.

C. Upon resolution of any conflicts, the Contractor shall provide a final Coordination Drawing(s) which will become the Master Coordination Drawing(s). The Master Coordination Drawing(s) shall be signed and dated by the Contractor to indicate acceptance of the arrangement of the work.

D. A reproducible copy of the Master Coordination Drawing(s) shall be provided by the Contractor to each of the appropriate subcontractor(s), the Resident Engineer and the Design Consultant for information.

E. Shop Drawings shall not be submitted prior to acceptance of the final coordinated drawings and shall be prepared in accordance with the Master Coordination Drawing(s). No work will be permitted without accepted Shop Drawings. It is therefore essential that this procedure be instituted as quickly as possible.

1.6 SUBMITTAL PROCEDURES:

A. Refer to Section 01 35 03 GENERAL MECHANICAL REQUIREMENTS and Section 01 35 06 GENERAL ELECTRICAL REQUIREMENTS for additional submittal requirements involving electrical and mechanical work or equipment of any nature called for the project.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activities, with the Submittal Schedule specified in Section 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
3. The Commissioner reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: The Submittals Schedule is set forth in Schedule F, which is included in the Addendum.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Design Consultant.
3. Include the following minimum information on label for processing and recording action taken:
   a. Project name, DDC Project Number and Contract Number
   b. Date
   c. Name and address of Design Consultant
   d. Name and address of Contractor
   e. Name and address of subcontractor
   f. Name and address of supplier
   g. Name of manufacturer
   h. Submittal number or other unique identifier, including revision identifier
   i. Number and title of appropriate Specification Section
   j. Drawing number and detail references, as appropriate
   k. Location(s) where product is to be installed, as appropriate
   l. Other necessary identification

E. Transmittal:

1. Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form in triplicate. Transmittals received from sources other than the

Contractor will be returned without review. Re-submission of the same drawings or product data shall bear the original number of the prior submission and the original titles.

2. Transmittal Form: Provide locations on form for the following information:

   a. Project name, DDC Project number and Contract Number
   b. Date
   c. Destination (To:)
   d. Source (From:)
   e. Names of Contractor, subcontractor, manufacturer, and supplier
   f. Category and type of submittal
   g. Submittal purpose and description
   h. Specification Section number and title
   i. Drawing number and detail references, as appropriate
   j. Transmittal number, numbered consecutively
   k. Submittal and transmittal distribution record
   l. Remarks
   m. Signature of transmitter

F. Shop Drawings:

1. Procedures for Preparing, Forwarding, Checking and Returning all Shop Drawings shall be, generally, as follows:

   a. The Contractor shall make available to its subcontractors the necessary Contract Documents and shall instruct such subcontractor to determine dimensions and conditions in the field, particularly with reference to coordination between the trade subcontractors. The Contractor shall direct its subcontractors to prepare Shop Drawings for submission to the Design Consultant in accordance with the requirements of these General Conditions. The Contractor shall also direct its subcontractors to "Ring Up" corrections made on all re-submissions for approval, so as to be readily seen, and that the symbol "sub" be used to identify the source of the correction or information that has been added.

      The Contractor shall:

      1. Review and be responsible to the Commissioner, for information shown on its subcontractor's Shop and Installation drawings and manufacturers' data, and also for conformity to Contract Documents.
      2. "Ring Up" corrections made on all submissions for approval, so as to be readily seen, and that the symbol "GC", "PL", "HVAC" or "EL" be used to indicate that the correction and/or information added was made by the Contractor and/or its subcontractor(s).
      3. Clearly designate which entity is to perform the work when the term, "work by others" or other similar phrases are indicated on the Contract Drawings before submission to the Design Consultant.
      4. Stamp submissions "Recommended for Acceptance", date and forward to the Design Consultant.

2. The Contractor shall promptly prepare and submit project specific layout detail and Shop Drawings of such parts of the work as are indicated in the Specifications, Schedule F of the Addendum or as required. These Shop Drawings shall be made in accordance with the Contract Drawings, Specifications and Supplementary Drawings, if any. The Shop Drawings shall be accurate and distinct and give all the dimensions required for the fabrication, erection and installation of the work.

3. Size of Drawings: The Shop Drawings, unless otherwise directed, shall be on sheets of the same size as the Contract Drawings, drawn accurately and of sufficient scale to be legible, with a one half (1/2) inch marginal space on each side and a two (2) inch marginal space for binding on the left side.

4. Scope of Drawings: Shop Drawings shall be numbered consecutively and shall accurately and distinctly represent all aspects of the work, including without limitation the following:

   a. All working and erection dimensions
   b. Arrangements and sectional views
   c. Necessary details, including performance characteristics, and complete information for making necessary connections with other work
   d. Kinds of materials including thickness and finishes
   e. Identification of products
   f. Fabrication and installation drawings
   g. Roughing-in and setting diagrams
   h. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring
   i. Shop work manufacturing instructions
   j. Templates and patterns
   k. Schedules
   l. Design calculations
   m. Compliance with specified standards
   n. Notation of coordination requirements
   o. Notation of dimensions established by field measurement
   p. Relationship to adjoining construction clearly indicated
   q. Seal and signature of professional engineer if specified
   r. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring
   s. All other information necessary for the work and/or required by the Commissioner

5. Titles and Reference: Shop Drawings shall be dated and contain:
   a. Name of the Project, DDC Project Number and Contract Number
   b. The descriptive names of equipment, or materials covered by the Contract Drawings and the classified item number or numbers, if any, under which it is, or they are required
   c. The locations or points and sequence at which materials, or equipment, are to be installed in the work
   d. Cross references to the section number, detail number and paragraph number of the Contract Specifications
   e. Cross references to the sheet number, detail number, etc., of the Contract Drawings

6. Field Measurements: In addition to the above requirements, the Shop Drawings shall be signed by the Contractor and, if applicable, the subcontractor responsible for preparation of the Shop Drawings. Each Shop Drawing shall be stamped with the following wording:

   FIELD MEASUREMENTS: The Contractor certifies that it has verified and supplemented the Contract Drawings by taking all required field measurements, which said measurements correctly reflect all field conditions and that this Shop Drawing incorporates said measurements.

7. Contractor's Statement with Submittal: Any Submittal by the Contractor for acceptance, including without limitation, all dimensional drawings of equipment, blueprints, catalogues, models, samples and other data relative to the equipment, the materials, the work or any part thereof, must be accompanied by a statement that the Submittal has been examined by the Contractor and that everything shown in the Submittal is in accordance with the requirements of the Contract Drawings and Specifications. If there is any discrepancy between what is shown in the Submittal and the requirements of the Contract Drawings and Specifications, the Contractor shall, in its statement, list and clearly describe each such discrepancy.

   Acceptance will be given based upon the Contractor's representation that what is shown in the Submittal is in accordance with the requirements of the Contract Drawings and Specifications. If

the Contractor's statement indicates any discrepancy between what is shown in the Submittal and the requirements of the Contract Drawings and Specifications, such change is subject to review and prior written acceptance by the Design Consultant. In addition, such change may require a change order in accordance with Article 25 of the Contract. In the event any such change is approved, any additional expense or increased cost in connection with the change is the sole responsibility of the Contractor.

8. Submission of Shop Drawings:

   a. Initial Submission: The Contractor shall submit seven (7) copies of each Shop Drawing to the Design Consultant for his/her review and acceptance. The Design Consultant will transmit Shop Drawings to appropriate sub-consultants for review and acceptance, including Commissioning Authority/Agent as applicable. A satisfactory Shop Drawing will be stamped "No Exceptions Taken", be dated and distributed by the Design Consultant as follows:
      1) Two (2) copies thereof will be returned to the Contractor by letter
      2) Three (3) copies of the approved Shop Drawing and copy of the transmittal letter to the Contractor will be forwarded to DDC
      3) One copy will be retained by the Design Consultant
      4) One copy will be forwarded / retained by sub-consultant(s) as appropriate

      Should the Shop Drawing(s) be "Rejected" or noted "Revise and Resubmit" by the Design Consultant, the Design Consultant will return the Shop Drawings to the Contractor with the necessary corrections and changes to be made as indicated thereon.

   b. Revisions: The Contractor must make such corrections and changes and again submit seven (7) copies of each shop drawing to the Design Consultant. The Contractor shall revise and resubmit the Shop Drawing as required by the Design Consultant until the Shop Drawings are stamped "No Exceptions Taken". However, Shop Drawings which have been stamped "Make Corrections Noted" shall be considered an "Acceptable" Shop Drawing and NEED NOT be resubmitted.

   c. Commencement of Work: No work or fabrication called for by the Shop Drawings shall be done until the acceptance of the said drawings by the Design Consultant is given. In addition to the foregoing Shop Drawing transmissions, a copy of any Shop Drawing prepared by any of the Contractor's subcontractors which Shop Drawing indicated work related to, adjacent to, impinging upon, or affecting work to be done by other subcontractors shall be transmitted to the subcontractors so affected. [These accepted Shop Drawings shall be distributed to the affected subcontractors when required with a copy of the transmittal to the Resident Engineer.]

   d. Variations: If the Shop Drawings show variations from the Contract requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in its letter of submittal. Acceptance of the Shop Drawings shall constitute acceptance of the subject matter thereof only and not of any structural apparatus shown or indicated.

G. Product Data:

1. General: Except as otherwise prescribed herein, the submission, review and acceptance of Product Data and Catalogue cuts shall conform to the procedures specified in Sub-Section 1.6 F, Shop Drawings.

2. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

3. Mark each copy of each submittal to show which products and options are applicable.

4. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

5. Submit Product Data before or concurrent with Samples.

6. Submission of Product Data:

a. Initial Submission: The Contractor shall submit seven (7) sets of Product Data to the Design Consultant for his/her review and acceptance. The Design Consultant will transmit Product Data to appropriate sub-consultants for review and acceptance, including Commissioning Authority/Agent as applicable. A satisfactory catalogue cut will be stamped "No Exception Taken", be dated and distributed as follows:

1) Two (2) copies thereof will be returned to the Contractor by letter

2) Three (3) copies of the Product Data and copy of the transmittal letter to the Contractor will be forwarded to DDC

3) One copy will be retained by the Design Consultant

4) One copy will be forwarded / retained by sub-consultant(s) as appropriate

Should the Product Data be “Rejected” or noted “Revise and Resubmit” by the Design Consultant, the Design Consultant will return one (1) set of such Product Data to the Contractor with the necessary corrections and changes to be made indicated and one (1) set to DDC.

7. Revisions: The Contractor must make such corrections and changes and again submit seven (7) copies of each Product Data for the review of the Design Consultant. The Contractor shall revise and resubmit the Product Data as required by the Design Consultant until the submission is stamped “No Exceptions Taken” by the Design Consultant. However, Product Data which has been stamped "Make Corrections Noted" shall be considered an "Accepted" Product Data and NEED NOT be resubmitted.

H. Samples of Materials:

1. For samples of materials involving electrical work of any nature, refer to Section 00 35 06 - General Electrical Requirements.

2. Samples shall be in triplicate, of sufficient size to show the quality, type, range of color, finish and texture of the material.

3. Each of the samples shall be labeled as follows:

a. Name of the Project, DDC Project Number and Contract Number
b. Name and quality of the material
c. Date

d. Name of Contractor, subcontractor, manufacturer and supplier
e. Related Specification or Contract Drawing reference to the samples submitted

4. A letter of transmittal, in triplicate, from the Contractor requesting acceptance must accompany all such samples.

5. Transportation charges to the Design Consultant's office must be prepaid on all samples forwarded.

6. Samples for testing purposes shall be as required in the Specifications.

7. Samples on Display: When samples are specified to be equal to approved product, they shall be carefully examined by the Contractor and by those whom the Contractor expects to employ for the furnishing of such materials.

8. Timely Submissions Log/Schedule: Samples shall be submitted in accordance with approved Shop Drawing log so as to permit proper consideration without delaying any operation under the project. Materials should not be ordered until acceptance is received, in writing, from the Design Consultant. All materials shall be furnished equal in every respect to the accepted samples.

9. The Acceptance of any samples will be given as promptly as possible, and shall be only for the characteristic color, texture, strength, or other feature of the material named in such approval, and no other. When this approval is issued by the Design Consultant, it is done with the distinct understanding that the materials to be furnished will fully and completely comply with the Specifications, the determination of which may be made at some later date by a laboratory test or by other procedure. Use of materials will be permitted only so long as the quality remains equal to the approved samples and complies in every respect with the Specifications, and the colors and textures of the samples on file in the office of the Design Consultant, for the project.

10. Acceptability of test Data: The Commissioner will be the final judge as to acceptability of laboratory test data and performance in service of materials submitted.

11. Valuable Samples: Valuable samples, such as hardware, plumbing and electrical fixtures, etc., not destroyed by inspection or test, will be returned to the Contractor and may be incorporated into the work after all questions of acceptability have been settled, providing suitable permanent records are made as to the location of the samples, their properties, etc.

12. Equivalent Quality: Any material, article and/or equipment which is designated in the Drawings and/or Specifications by a number in the catalogue of any manufacturer or by a manufacturer's grade or trade name is designated for the purpose of describing the material, article and/or equipment and fixing the standard of performance and/or function, as well as the quality and/or finish. Any material, article and/or equipment which is other than what is specified in the Drawings and/or Specifications will only be accepted if the Commissioner makes a written determination that such material, article and/or equipment is equivalent to that which is specified in the Drawings and/or Specifications.

13. The submission of any material, article and/or equipment as the equal of any material, article and/or equipment set forth in the Drawings and/or Specifications as a standard shall be accompanied by any and all information essential for determining whether such proposed material, article and/or equipment is equivalent to that which is specified. Such information shall include, without limitation, illustrations, drawings, descriptions, catalogues, records of tests, samples, as well as information regarding the finish, durability and satisfactory use of such proposed material, article and/or equipment under similar operating conditions.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 1.7

1.7 LEED SUBMITTALS:

A. Comply with submittal requirements specified in Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL; Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS; Section 01 81 13.13, VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS AND COATINGS FOR LEED BUILDINGS; Section 01 81 19, INDOOR AIR QUALITY REQUIREMENTS FOR LEED BUILDINGS and Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS.

B. LEED Building submittal information shall be assembled into one package per each applicable specification section, separate from all other non-LEED submittals. Each submittal package shall have a separate transmittal and identification as described in Sub-Section 1.5 herein.

C. Number of Copies: Submit FOUR (4) copies of LEED submittals, in accordance with procedure described in Article 1.5 herein, unless otherwise indicated.

D. Material Safety Data Sheets (MSDSs) for LEED Certification: Submit information necessary to show compliance with LEED certification requirements, which will be the limit of the Design Consultant's review for LEED compliance.

1. Designated LEED submittals that include non-LEED MSDS data will not be reviewed. The entire submittal will be returned for re-submission.

E. Product Cut Sheets and/or Shop Drawings for LEED Certification: Provide product cut sheets and/or shop drawings with the Contractor's or sub-contractor's stamp, confirming that the submitted products are the products installed in the Project. For detailed requirements refer to Sub-Section 1.6 of Section 01 81 13 SUSTAINALE DESIGN REQUIREMENTS FOR LEED PROJECTS.

1. Provide the quantity, length, area, volume, weight, and/or cost of each product submitted as required to satisfy LEED documentation requirements. Refer to Sub-Section 1.6 of Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS FOR LEED PROJECTS.

1.8 ULTRA LOW SULFUR DIESEL FUEL AND BEST AVAILABLE TECHNOLOGY REPORTING:

A. In accordance with Section 01 10 00 Summary, Sub-Section 1.5 E, the Contractor shall submit reports to the Commissioner regarding the use of Ultra Low Sulfur Diesel Fuel and Best Available Technology (BAT) in Non road Vehicles. Submission of such reports shall be in accordance with the schedule, format, directions and procedures established by the Commissioner.

1.9 CONSTRUCTION PHOTOGRAPHS AND DVD RECORDINGS:

A. Submit construction progress photographs and DVD recordings in accordance with requirements of Section 01 32 33, PHOTOGRAPHIC DOCUMENTATION

1.10 AS-BUILT DOCUMENTS:

A. Submit all as-built documents in accordance with Section 01 78 39 CONTRACT RECORD DOCUMENTS.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 35 03
GENERAL MECHANICAL REQUIREMENTS

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 35 03

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. The General Mechanical Requirements contained herein shall be followed by the Contractor, as well as its subcontractor for HVAC work. This Section sets forth the General Requirements applicable to mechanical work for the Project. Such requirements are intended to be read in conjunction with the Specifications and Contract Drawings for the Project. In the event of any conflict between the requirements set forth in this Section and the requirements of the Specifications and/or the Contract Drawings, whichever requirement is the most stringent, as determined by the Commissioner, shall take precedence.

1.3 RELATED SECTIONS: Include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 33 00 SUBMITTAL PROCEDURES
C. Section 01 35 06 GENERAL ELECTRICAL REQUIREMENTS
D. Section 01 42 00 REFERENCES
E. Section 01 77 00 CLOSEOUT PROCEDURES
F. Section 01 78 39 CONTRACT RECORD DOCUMENTS

1.4 DEFINITIONS:

A. CONCEALED PIPING AND DUCTS -: shall mean piping and ducts hidden from sight in masonry or other construction, in floor fill, trenches, partitions, hung ceilings, furred spaces, pipe shafts and in service tunnels not used for passage. Where piping and ducts run in areas that have hung ceilings, such piping and ducts shall be installed in the hung ceilings. For work on existing piping any insulation on such existing piping is to be tested for asbestos and abated, if found to be positive by a certified asbestos contractor. Such testing and abatement shall occur prior to the performance of any work on these pipes.

1.5 SUBMITTALS:

A. INTENT OF MECHANICAL CONTRACT DRAWINGS – Mechanical Contract Drawings are in part diagrammatic and show the general arrangement of the equipment, ducts and piping included in the Contract and the approximate size and location of the equipment.

B. The Contractor shall follow these Contract Drawings in laying out the work and verify the spaces in which it will be installed. The Contractors shall submit, as directed, Mechanical Shop Drawings, roughing drawings, manufacturer's Shop Drawings, field drawings, cuts, bulletins, etc., of all materials, equipment and methods of installation shown or specified in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1. Submit sheet metal shop standards. Submit manufacturer's product data including gauges, materials, types of joints, scaling materials and installations for metal ductwork materials and products.

2. Submit scaled layout drawing (3/8"=1') of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, slopes of horizontal runs, wall and floor penetrations and connections. Show modifications of indicated requirements made to conform to local shop practice and how those modifications ensure that free area, materials and rigidity are not reduced. Layouts should include all the room plans, mechanical equipment rooms and penthouses. Method of attachment of duct hangers to building construction all with the support details. Coordinate shop drawings with related trades prior to submission.

3. Indicate duct fittings, particulars such as gauges, sizes, welds and configuration prior to start of work for low-pressure systems.

4. Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data and shop drawings in maintenance manual.

1.6 ACCESSIBILITY:

All work shall be installed by the Contractor so as to be readily accessible for inspection, operation, maintenance and repair. Minor deviations from the arrangement indicated on the Contract Drawings may be made to accomplish this, but they shall not be made without approval by the Commissioner.

1.7 CHANGES IN PIPING, DUCTS, AND EQUIPMENT:

Wherever field conditions are such that for proper execution of the work, reasonable changes in location of piping, ducts and equipment are necessary and required, the Contractor shall make such changes as directed and approved, without extra cost to the City.

1.8 CLEANING OF PIPING, DUCTS, AND EQUIPMENT:

Piping, ducts and equipment shall be thoroughly cleaned by the Contractor of all dirt, cuttings and other foreign substances. Should any pipe, duct or other part of the several systems be obstructed by any foreign matter, the Contractor will be required to pay for disconnecting, cleaning and reconnecting wherever necessary for the purpose of locating and removing obstructions. The Contractor shall pay for repairs to other work damaged in the course of removing obstructions. For work on existing piping, ducts and equipment the Contractor shall pay special attention during this task so as not to disturb the insulation on such piping, ducts or equipment.

1.9 STANDARDIZATION OF SIMILAR EQUIPMENT:

Unless otherwise particularly specified, all equipment of the same kind, type or classification, and used for identical purposes, shall be the product of one (1) manufacturer.

1.10 SUPPORTING STRUCTURES DESIGNED BY THE CONTRACTOR:

Unless otherwise specified, supporting structures for equipment to be furnished by the Contractor shall be designed by an Engineer licensed in New York State retained by the Contractor. Supporting structures shall be built by the Contractor of sufficient strength to safely withstand all stresses to which they may be subjected, within permissible deflections, and shall meet the following standards:

A. Structural Steel - ASTM Standard Specifications, AISC and New York City Construction Codes.

B. Concrete for supports for equipment shall conform to the Specifications for concrete herein, but in no case shall be less than the requirements of the New York City Construction Codes for average concrete.

C. Steel reinforcement for concrete shall be of intermediate grade and shall meet the requirements of the Standard Specifications for Billet Steel-Concrete Reinforcement Bars, ASTM.

D. Drawings and calculations shall be submitted for review and acceptance in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

1.11 ELIMINATION OF NOISE:

A. All systems and/or equipment provided under the Contract shall operate without objectionable noise or vibration.

B. Should operation of any one or more of the several systems produce noise or vibration which is, in the opinion of the Commissioner, objectionable, the Contractor shall at its own expense make changes in piping, equipment, etc. and do all work necessary to eliminate objectionable noise or vibration.

C. Should noise or vibration found objectionable by the Commissioner be transmitted by any pipe or portions of the structure from systems and/or equipment installed under the Contract, the Contractor shall at its own expense install such insulators and make such changes in or additions to the installations as may be necessary to prevent transmission of this noise or vibration.

1.12 PRELIMINARY FIELD TEST:

As soon as conditions permit, the Contractor shall furnish all necessary labor and materials for, and shall make, preliminary field tests of the equipment to ascertain compliance with the requirements of the Contract. If the preliminary field tests disclose equipment that does not comply with the Contract, the Contractor shall, prior to the acceptance test, make all changes, adjustments and replacements required.

1.13 INSTRUCTIONS ON OPERATION:

At the time the equipment is placed in permanent operation by the City, the Contractor shall make all adjustments and tests required by the Commissioner to prove that such equipment is in proper and satisfactory operating condition. The Contractor shall instruct the City's operating personnel on the proper maintenance and operation of the equipment for the period of time called for in the Specifications.

1.14 CERTIFICATES:

On completion of the work, the Contractor shall obtain certificates of inspection, approval, acceptance and of compliance with all laws from all agencies and/or entities having jurisdiction over the work and shall deliver these certificates to the Commissioner in accordance with Section 01 77 00 CLOSEOUT PROCEDURES. The work shall not be deemed substantially complete until the certificates have been delivered. See General Comments regarding problems with specifying items required for substantial completion.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 35 03

SECTION 01 35 06
GENERAL ELECTRICAL REQUIREMENTS

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section sets forth the General Requirements applicable to electrical work for the Project. Such requirements are intended to be read in conjunction with the Specifications and Contract Drawings for the Project. In the event of any conflict between the requirements set forth in this Section and the requirements of the Project Specifications and/or the Contract Drawings, whichever requirement is the most stringent, as determined by the Commissioner, shall take precedence.

B. This Section includes the following:

1. Procedure for Electrical Approval
2. Submittals
3. Electrical Installation Procedures
4. Electrical Conduit System Including Boxes (Pull, Junction and Outlet)
5. Electrical Wiring Devices
6. Electrical Conductors and Terminations
7. Circuit Protective Devices
8. Distribution Centers
9. Motors
10. Motor Control Equipment
11. Schedule of Electrical Equipment

1.3 RELATED SECTIONS: Include without limitation the following:

A.	Section 01 10 00	SUMMARY
B.	Section 01 33 00	SUBMITTAL PROCEDURES
C.	Section 01 35 03	GENERAL MECHANICAL REQUIREMENTS
D.	Section 01 42 00	REFERENCES
E.	Section 01 77 00	CLOSEOUT PROCEDURES
F.	Section 01 78 39	CONTRACT RECORD DOCUMENTS

1.4 DEFINITIONS:

A. WIRING: means both wire and raceway (rigid steel, heavy wall conduit unless specifically indicated otherwise).

B. POWER WIRING: means wiring from a panel board or other specified source to a starter (if required) then to a disconnect (if required), then to the final point of usage such as a motor, unit or device.

C. CONTROL and/or INTERLOCK WIRING: means that wiring that signals the device to operate or shut down in response to a signal from a remote control device such as a temperature, smoke, pressure, float,

etc. device (starters and disconnect switches are not included in this definition) regardless of the voltage required for the controlling device.

D. RIGID STEEL CONDUIT: shall mean rigid steel, heavy wall conduit that is hot dipped galvanized inside and outside. The conduit shall meet the requirements of the latest edition, as amended, of the "Standard for Rigid Steel Conduit" of the Underwriters' Laboratories, Inc. Unless otherwise specified in the Specifications or indicated on the Contract Drawings, rigid steel conduit shall be used for all exposed work, for all underground conduits in contact with earth and for fire alarms systems, as required by the New York City Construction Codes.

E. ELECTRICAL METALLIC TUBING (EMT): shall mean industry standard thin wall conduit of galvanized steel only. All elbows, bends, couplings and similar fittings which are installed as a part of the conduit system shall be compatible for use with electric metallic tubing. Couplings and terminating fittings shall be of the pressure type as approved by the Commissioner. Set screw fittings will not be acceptable. EMT shall meet the requirements of the latest edition, as amended, of the "Standard for Electrical Metallic Tubing of the Underwriters Laboratories Inc." EMT may only be used where specifically indicated. In no case will EMT be permitted in spaces other than hung ceilings and dry wall partitions.

F. FLEXIBLE METALLIC CONDUIT (FMC): Shall mean a conduit made through the coiling of a self-interlocking ribbed strip of aluminum or steel, forming a hollow tube through which wires can be pulled. For final connections to motors and motorized equipment, not more than a 4' - 0" length of flexible conduit may be used. For watertight installations, this conduit shall be of a watertight type, attached with watertight glands or fittings for final connections from outlet box to recessed lighting fixtures and in locations only where specifically permitted by the Specifications or Contract Drawings.

1.5 PROCEDURE FOR ELECTRICAL APPROVAL:

This Sub-Section sets forth General Electrical information, as well as required approvals for all electrical work required for the Project, including ancillary electrical work which may be included in the work of other trade subcontractors.

A. ELECTRIC SERVICE: The electric service supply is subject to commercial and operating variation of the utility company. Proper provision shall be made to have all apparatus operate normally under these conditions.

B. ACCEPTANCE: Acceptance and approval of the work will be contingent upon the inspection and test of the installation by the City regulatory agency.

C. TESTS: The Contractor shall notify the Commissioner when the Contractor has completed the work and is ready to have it inspected and tested. Upon completion of the work tests shall be made as required by the Commissioner of all electrical materials, electrical and associated mechanical equipment, and of appliances installed hereunder. The Contractor shall furnish all labor and material for such tests. Should the tests show that any of the material, appliances or workmanship is not first class or not in compliance with the Contract, the Contractor on written notice shall remove and promptly replace them with other materials in conformity with the Contract.

D. CERTIFICATE OF THE BUREAU OF ELECTRICAL CONTROL, OF THE DEPARTMENT OF BUILDINGS (B.E.C.): The Contractor must file prior to requesting a substantial completion inspection a Certificate of Inspection issued by B.E.C. On completion of the work the Contractor shall obtain certificates of inspection, approval, acceptance and compliance from all agencies and/or entities having jurisdiction over the work and shall deliver these certificates to the Commissioner in accordance with Section 01 77 00 CLOSEOUT PROCEDURES.

E. RESPONSIBILITY FOR CARE AND PROTECTION OF EQUIPMENT:

1. The Contractor furnishing any equipment shall be responsible for the equipment until it has been finally inspected, tested and accepted, in accordance with the requirements of the Contract.

2. After delivery and before and after installation, the Contractor shall protect all equipment against theft, injury or damage from all causes. The Contractor shall carefully store all equipment received for work, which is not immediately installed. If any equipment has been subject to possible injury by water, it shall be thoroughly dried out and put through a special dielectric test as directed by the Commissioner, at the expense of the Contractor or replaced by the Contractor without additional cost to the City.

F. UNIFORMITY OF EQUIPMENT: Any two (2) or more pieces of equipment, apparatus or materials of the same kind, type or classification which are intended to be used for identical types of service, shall be made by the same manufacturer.

1.6 SUBMITTALS:

A. CONTRACTOR'S ELECTRICAL DRAWINGS AND SAMPLES FOR APPROVAL:

1. The Contractor shall submit to the Commissioner for approval, in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, complete dimensional drawings of all equipment, wiring diagrams, motor test data, details of control, installation layouts showing all details and locations and including all schedules, and descriptions and supplementary data to comprise complete working drawings and instructions for the performance of the work. A description of the operation of the equipment and controls shall be included. A letter, in triplicate, shall accompany each submittal.

2. The Contractor shall submit in accordance with Section 01 33 00 SUBMITTAL PROCEDURES, duplicate samples of such materials and appliances as may be requested by the Commissioner for approval. These samples shall be properly tagged for identification and submitted for examination and test. After the samples are approved, one (1) sample will be returned to the Contractor and the other sample will be filed in the office of the Commissioner's representative for inspection use. After the Contract is completed, the second set of samples will be returned to the Contractor.

B. TIMELINESS: All material shall be submitted in accordance with the submittal schedule in sufficient time for the progress of construction. Failure to promptly submit acceptable samples and dimensional drawings of equipment will not be accepted as grounds for an extension of time. The Commissioner may decline to consider submittals unless all related items are submitted at the same time.

C. CONTRACTOR'S STATEMENT WITH SUBMITTALS: Contractor shall submit statement in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

D. BULLETINS AND INSTRUCTIONS: The Contractor shall furnish and deliver to the Commissioner in accordance with Section 01 78 39, CONTRACT RECORD DOCUMENTS and Section 01 77 00, CLOSEOUT PROCEDURES, after acceptance of the work, four (4) complete sets of instructions, technical bulletins and any other printed matter (diagrams, prints, or drawings) required to provide complete information for the proper operation, maintenance and repair of the equipment and the ordering of spare parts.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

3.1 ELECTRICAL INSTALLATION PROCEDURES:

This Sub-Section sets forth the General Installation Procedure that shall apply to all electrical work and electrical equipment appearing in the Contract.

(Refer to Sub-Section 1.4 DEFINITIONS for terms used in this section)

A. INTENT OF CONTRACT DOCUMENTS: The Drawings and Specifications are to be interpreted as a means of conveying the scope and intent of the work without giving every minor electrical detail. It is intended, nevertheless, that the Contractor shall provide whatever labor and materials are found necessary, within the scope of the Contract, for the successful operation of the installation. Specific details of individual installations are to be finally decided upon when the Contractor submits Working or Shop Drawings for approval to DDC. Whenever there are two (2) or more methods to complete project work within the Contract scope, the Commissioner reserves the right to choose that method which, in the Commissioner's opinion, will afford the most satisfactory performance, lasting qualities, and accessibility for repairs, even though this selection is the most costly.

B. SCHEMATIC PLANS – APPROXIMATE LOCATIONS: Conduits and wiring are shown on the plans for diagrammatic purposes only. Therefore, conduit layouts may not necessarily give the actual physical route of the conduits. The Contractor who installs a conduit system will also be required, as part of the work, to furnish and install all hangers and pull-boxes, including any special pull-boxes found necessary to overcome interferences, and to facilitate the pulling of electrical cables. Similarly, the locations of equipment, appliances, outlets and other items shown on Contract Drawings are only approximate and are to be definitively established when equipment Shop Drawings are submitted and approved by DDC during construction.

C. SLEEVES: required for conduits passing through walls or floors, shall be furnished and set by the Contractor installing the conduits. Sleeves in waterproofed floors shall be provided with flashing extending 12 inches in all directions from sleeve and secured to waterproofing. Flashing shall be turned down into space between pipe and sleeve and caulked watertight. Flashing shall be 20 oz. cold rolled copper. Sleeves shall be supplied with welded flanges similar to those supplied by the subcontractor for Plumbing Work and shall extend one (1) inch above finished floor.

D. COORDINATION: The Contractor shall keep in close touch with the construction progress and obtain the necessary information for the accurate placement of its work in ample time before project construction operations obstruct its work. The Contractor is to consult all other Contract Drawings, as well as approved equipment Shop Drawings on file in the Resident Engineer's Field Office. This will aid in avoiding interferences, omissions and errors in the electrical installation.

E. RESTORATION: If drilling or cutting is done on finished surfaces of equipment or the structure, any marring of the surface shall be repaired or replaced by the Contractor. The Contractor shall be held responsible for corrective restoration due to its cutting or drilling, and for any damage to the project or its contents caused by the Contractor or the Contractor's workers. If any piercing of waterproofing occurs because of the installation of the work, the Contractor shall restore the waterproofing, at its own expense, to the satisfaction of the Commissioner.

F. ELECTRICAL WORK AT SITE: The Contractor furnishing equipment consisting of a number of related electrical devices or appliances, mounted in a single enclosure, or on a common base, shall furnish this unit complete with internal wiring, connections, terminal boxes with copper connectors and/or lugs and ample electrical leads, ready for connection and operation. The cost of any wiring, re-wiring or other work required to be done on this unit in the field, shall be borne by the Contractor, without additional cost to the City.

G. COOPERATION AMONG SUBCONTRACTORS: Whenever an electrically operated unit or system involves the combined work of several subcontractors for its installation and successful operation, the

Contractor shall require each subcontractor to exercise the utmost diligence in cooperating with others to produce a complete, harmonious installation.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.2

3.2 ELECTRICAL CONDUIT SYSTEM INCLUDING BOXES (PULL, JUNCTION AND OUTLET):

This Sub-Section sets forth the requirements applying to the installation of electrical conduits, boxes or fittings. Rigid steel conduit shall be used throughout, unless otherwise directed by the Commissioner. Where the word 'conduit', without a modifier such as, rigid steel, EMT, etc., is specified to be used, it shall be interpreted to mean, rigid steel, heavy wall, threaded conduit.

(Refer to Sub-Section 1.4 DEFINITIONS for terms used in this section)

A. INSTALLATIONS AND APPLICATIONS:

1. Unless otherwise specified or indicated on the Contract Drawings, conduit runs shall be installed concealed in finished spaces.
2. CONDUIT SIZES: The sizes of conduit shall be as indicated on the Contract Drawings. Wherever conduit sizes are not indicated, the conduit shall meet the requirements of the New York City Electrical Code to accommodate the conductors to be installed therein.
3. Conduits shall be reamed smooth after cutting. No running threads will be permitted. Universal type couplings shall be used where required. Conduit joints shall be screwed up to butt. Empty conduits after installation shall have all open ends temporarily plugged to prevent the entrance of water or other foreign matter.
4. Conduits being installed in concrete or masonry shall be securely held in place during pouring and construction operations. A group of conduits terminating together shall be held in place by a template.
5. UNDERGROUND STEEL CONDUITS: Unless otherwise specified, all underground steel conduits in contact with earth shall be encased by the Contractor who installs them, in a covering of not less than two (2) inches of an approved concrete mixture. Concrete mix shall be one (1) part cement to four and one-half (4 ½) parts of fine and coarse aggregate.
6. EXCAVATION RESTORATION PERMITS: When installing underground conduits, duct banks or manholes the Contractor shall perform the work of cutting pavement, excavation shoring, keeping trenches or holes pumped dry, backfilling, restoration of surfaces to original condition and removal of excess earth and rubbish from premises. During the work, the Contractor shall provide adequate crossovers, protective barriers, lamps, flags, etc., to safeguard traffic and the public. When the work is in a public highway or street, the Contractor shall secure and pay for all necessary permits and inspection fees and pay the cost of repaving.
7. EXPOSED CONDUIT SUPPORTS: Exposed conduit shall be supported by Galvanized hangers with necessary inserts, beam clamps of approved design or attached to walls or ceilings by expansion bolts. Exposed conduits shall be supported or fastened at intervals not more than five (5) feet.
8. Exposed conduit shall be installed parallel or at right angles to ceiling, walls and partitions. Where direction changes of exposed conduit cannot be made with neat bends, such as required around beams or columns, conduit type fitting shall be used.

9. The conduit shall be installed with an approved expansion joint:

   a. Wherever the conduit crosses a building expansion joint the Contractor will be held responsible for determining where the building expansion joints are located.

   b. Every 200 feet, when in straight runs of 200 feet or longer.

10. Conduit may only enter and leave a floating slab in the vertical direction, and then only in an approved manner. Horizontal entries into floating slabs are not permitted.

11. Conduit installed in pipe shafts shall be properly supported to carry the total weight of the raceway system complete with cable. In addition at least one (1) horizontal brace per 10 ft. section shall be provided to assure stability of the raceway system.

12. BUSHINGS AND LOCKNUTS: Approved bushings and locknuts shall be used wherever conduits enter outlet boxes, switch boxes, pull boxes, panel board cabinets, etc.

13. CONDUIT BENDS: shall be made without kinking conduit or appreciably reducing the internal diameter. All bends in conduit of two (2) inch in diameter or larger shall be made with an hydraulic or power pipe bender. The radius of the inner edge of any bend shall not be less than six (6) times the internal diameter of the conduit where rubber covered conductors are to be installed, and not less than 10 times the internal diameter of the conduit where lead covered conductors are to be used. Long gradual sweeps will be required, rather than sharp bends, when changes of direction are necessary.

14. EMPTY CONDUITS

   a. TESTS: All conduits and ducts required to be installed and left empty shall be tested for clear bore and correct installation by the Contractor using a ball mandrel and a brush and snake before the installation will be accepted. The ball shall be turned to approximately 85% of the internal diameter of the raceway to be tested. Two (2) short wire brushes shall be included in the mandrel assembly. Snaking of conduits, ducts, etc., shall be performed by the Contractor in the presence of the Resident Engineer. Any conduits or ducts which reject the mandrel shall be cleared at once with the Contractor bearing all costs, such as chopping concrete, to replace the defective conduit and restore the surface to its original condition.

   b. TAGS: Numbers or letters shall be assigned to the various conduit runs, and as they test clear they shall be identified by a fiber tag not less than 1-¼ inch width, attached by means of a nylon cord. All conduit terminations in panel, splice or pull boxes as well as those out of the floor or ceiling shall be tagged.

   c. TEST RECORDS: As the conduit runs clear, a record shall be kept under the heading of "Empty Conduit Tested, Left Clear, Tagged and Capped" showing conduit designation, diameter, location, date tested and by whom. When complete, this record shall be signed by the Resident Engineer and submitted in triplicate for approval. This record shall be entered on the Contract Record Drawings under Section 01 78 39, CONTRACT RECORD DOCUMENTS.

   d. CAPPING: All empty conduit and duct openings, after test, shall be capped or plugged by the Contractor as directed.

   e. DRAG LINES: A drag line shall be left in all empty conduit.

B. BOXES:

1. The Contractor shall furnish and erect all pull boxes indicated on the plans or where required. Sides, top and bottom of pull boxes shall be Galvanized coated and shall be built of No. 12 USSG steel reinforced at corners by substantial angle irons and riveted or welded to plates. Bottom or side

of pull boxes shall be removable and held in place by corrosion resistant machine screws. Pull boxes in damp locations shall have threaded hubs and gaskets and be NEMA 4X. All pull boxes shall be suspended from ceiling or walls in the most substantial manner.

2. In centering outlets, the Contractor is cautioned to allow for overhead pipes, ducts and other obstructions, and for variations in arrangement and thickness of fireproofing, soundproofing and plastering. Precaution should be exercised regarding the location of window and door trims, paneling, etc. Mistakes resulting from failure to exercise precaution must be corrected by the Contractor at no additional cost to the City. Outlets in hung ceilings shall be supported from the black iron or structure.

3. The exact location of all outlets in finished rooms shall be as directed. When the interior finish has been applied, the Contractor shall make any necessary adjustment of its work to properly center the outlets. All outlet boxes for local switches near doors shall be located at the strike side of doors as finally hung, whether so indicated on the drawings or not.

4. Exposed wall outlet boxes shall be erected neatly and tight against the walls and securely anchored to same.

5. All wall outlets of each type shall be set accurately at the same level on each floor, except where otherwise specified or directed. Where special conditions occur, outlets shall be located as directed.

6. MOUNTING HEIGHTS: The following heights are standard heights and are subject to correction due to coordination with Contract Drawings. All such changes must be approved by the Resident Engineer. Heights given are from finished floor to center line of outlet or device on wall or partition, unless otherwise indicated.

a.	General Convenience Outlets (mount vertical)	1'-6"
b.	Clock Outlets	8'-6"or 1'-6" below ceiling
c.	Wall Lighting Switches	4'-0"
d.	Motor Controllers	5'-0"
e.	Motor Push-button	4'-2"
f.	Telephone Outlets	As Directed
g.	Fire Alarm Bells	8'-6"or 1'-6" below ceiling
h.	Fire Alarm Stations	4'-0"
i.	Intercom Outlet	1'-6"
j.	Cooking and Refrigerator Unit	As Directed

7. Outlet boxes shall be of approved design and construction; of form and dimensions suited and adapted to its specific location; the kind of fixture to be used and the number and arrangements of conduits, etc., connecting therewith. All ferrous outlet boxes shall meet the requirements for zinc coating as specified under Electrical Conduit Systems.

8. There shall be knockouts opened only for the insertion of conduit. Any outlet boxes with more openings than are necessary for conduit insertion shall be sealed by the Contractor without additional charge.

9. All outlet boxes and junction boxes for exposed work shall be galvanized cast iron or cast aluminum with threaded openings. Outlet boxes for exposed inside work in damp locations shall be galvanized cast iron or cast aluminum with threaded hubs and neoprene gaskets.

10. Junction boxes shall not be less than 4 11/16" square and shall be equipped with zinc coated plates. Where plates are exposed they shall be finished to match the room decor.

11. FIXTURE SUPPORTS: Outlet boxes supporting lighting fixtures shall be equipped with fixture studs held by approved galvanized stove bolts or integral with the box. Cast iron or malleable boxes shall have four (4) tapped holes for mounting required cover or fixtures.

12. Outlet boxes exposed to the weather or indicated W.P. shall be cast iron or cast aluminum and the covers made watertight with neoprene gaskets. The boxes shall have external lugs for mounting. Drilling of the body of the fitting for mounting will not be permitted. The cover screws shall be appropriate in size, non-corrodible and not less than four (4) in number for each box opening.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.3

3.3 ELECTRICAL WIRING DEVICES:

A. WALL SWITCHES shall be of the best specification grade, quiet type, and shall have a rating of 20 Amperes at 277 volts, as manufactured by Bryant, Hubbell or approved equal. The mechanism shall be equipped with arc snuffers. They shall be of the tumbler type, single pole. Switches of the 3-way type shall have a similar rating.

B. RECEPTACLES:

1. CONVENIENCE OUTLETS: shall be of the best specification grade, duplex, two-pole, 3-wire, 20 Amperes at 125 volts. It shall have a grounding pole that shall be grounded to the conduit system. Receptacles shall be capable of both back and side wiring and shall have only one (1) grounding screw. Receptacles shall be Hubbell Cat. #5262 or approved equal.

2. HEAVY DUTY RECEPTACLE OUTLETS: shall have the Ampere rating and the number of poles specified on the Contract Drawings and shall be Hubbell, Russell-Stoll, Bryant, AH & H or approved equal. Each outlet shall have a grounding pole, which shall be grounded to the conduit system.

3. FLOOR RECEPTACLES: shall be Russell & Stoll #3040 or approved equal, to fit into floor box previously specified.

4. NAMEPLATES: are required for all receptacles other than 120V.

C. CLOCK HANGERS: Clock outlets for surface type clocks shall be equipped with a supporting hook and recessed faceplate to conceal the electrical cord.

D. WATERTIGHT DEVICES: For installations exposed to weather or in damp locations, the devices shall be in a gasketed, cast iron enclosure.

E. PLATES:

1. Every convenience outlet and switch outlet shall be covered by means of a stainless steel No. 302 - 0.4" antimagnetic plate with an approved finish, unless provided otherwise in the detailed Specifications.

2. Where two (2) or three (3) switches are grouped together, a single faceplate shall be used. Where more than three (3) switches are located at one (1) point, the faceplates may be made up in multiple units.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4

3.4 ELECTRICAL CONDUCTORS AND TERMINATIONS:

A. CONDUCTORS FOR LIGHT AND POWER - All wire and cable shall be of annealed copper of 98% conductivity. Aluminum wire or cable will not be permitted. The insulation shall be flame retardant, moisture and heat resistant, thermoplastic, type THW or THWN rated for 600 volts at 75 degrees C. for

both wet and dry locations. Wires No. 8 or larger shall be stranded. Wires and cables shall also be subject to the requirements of the NYCEC. Cables for incoming service or wire in conduits contiguous with the earth or in concrete or other damp or wet locations shall be synthetic rubber insulated with neoprene jacket, heat and moisture resistant and shall be equal to UL Type USE and rated for 600 volts at 75 degrees C. for both wet and dry locations.

B. FIXTURE WIRE: Lighting fixtures shall be wired with No. 14 gauge wire designated as AWM and rated at 105 degrees C.

C. OTHER TYPES: Cables and wires for interior communication systems are described in applicable detailed Specifications.

D. MINIMUM SIZE: Conductors smaller than No. 12 AWG shall not be used for light or power.

E. COLOR CODE: Wires shall have a phase color code, and multiple conductor cables shall be color coded.

F. CABLE DATA: The Contractor shall submit for approval the following information for each size and type of cable to be furnished.

1. Manufacture of Cable - Location of Plant.
2. Minimum insulation resistance at standard test temperature.
3. Days required for delivery to site of work after order to proceed with manufacture.

G. ORIGINAL REELS: Cable and wire shall be delivered to the site of the work on original sealed factory reels.

H. WIRE INSTALLATION:

1. INSTALL WIRES AFTER PLASTERING - Feeder and branch circuits wiring shall not be installed in conduit before the rough plastering work is completed. No conductors shall be pulled into floor conduits before floor is poured.
2. CONDUIT SECURED IN PLACE - No conductor shall be pulled into any conduit run before all joints are made up tightly and the entire run rigidly secured in place.
3. WIRE ENDS - All wires shall be left with sufficiently long ends for proper connection and stowing.
4. PULLING COMPOUNDS - When required to ease the pulling-in of wires into conduit, only approved compounds as recommended by cable manufacturers shall be used.
5. PRESSURE CONNECTORS - for wires shall be of the cast copper or forged copper pressure plate type. Connectors shall be O.Z., Burndy, National Electric Products or approved equal.
6. Splices and feeder taps in the gutters of panel boxes shall be made by means of pressure plate type connectors encased in composition covers as manufactured by O.Z., Burndy, National Electric Products or approved equal.
7. Splices in branch wiring for sound systems and fire systems, shall be first made mechanically secure, then soldered and taped.
8. In lieu of soldered splices (except for sound and Fire Systems, which must have soldered splices) the following alternates are acceptable for operating temperatures up to 105 degrees C., for fluorescent fixtures and for the splicing of branch circuit wiring up to No. 8 AWG wire:
   a. Mechanical splices made with mechanical connectors as manufactured by the Minnesota Manufacturing Company "Scotchlock" or approved equal. Mechanical connectors requiring a special tool (pressure connectors, insulators and locking rings) by Buchanan or approved equal. The tool used for connector application shall be as approved by the connector manufacturer.

b. For wire and cable No. 6 AWG and larger for branch circuit wiring the seamless tubular connector will only be accepted. Application of this connector shall be with a tool recommended by the connector manufacturer.

9. TAGS: All feeders and risers shall be tagged at both ends, and in all pull and junction boxes and gutter spaces through which they pass. Such tags shall be of fiber and have the feeder designation and size stamped thereon.

10. BRANCH CIRCUIT WIRING:

a. The Contractor installing branch circuit wiring shall test the work for correct connections and leave all loop splices in the fixture outlet boxes properly spliced and taped. The Contractor shall provide wire ends long enough for convenient connection to device.

b. NEUTRALS: No common neutrals shall be used except for lighting branch circuits. Each neutral wire shall be terminated separately on a neutral busbar in the panelboard. No common neutrals will be permitted for convenience receptacle branch circuits.

I. TERMINATIONS

1. LUGS: All lugs for all devices and all cable terminations shall be copper. AL/CU rated lugs will not be permitted. The only exception to this requirement is when the particular device is not manufactured with copper lugs by any manufacturer. Lugs for No. 6 AWG cable and larger shall be cast copper or forged copper pressure plate type. Lugs for 1/0 and larger shall be fastened with two (2) bolts.

2. All lugs shall be of the proper size to accept the cable connected to them. Any subcontractor furnishing a device containing lugs is to coordinate with the Contractor to insure that the device terminations are adequate for the wire or cable (whose size may be larger than expected due to voltage drop considerations) connected to the device.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.5

3.5 CIRCUIT PROTECTIVE DEVICES:

This Section sets forth the circuit protective devices such as circuit breakers and safety switches, used in connection with Motor Control Equipment, Distribution Centers, Panel boards and Service Entrance.

A. CIRCUIT BREAKERS:

1. CIRCUIT BREAKERS: shall be operable in any position and shall be of the quick-make, quick-break type on manual operation. The handle shall be trip free, preventing contacts from being held in closed position against abnormal overloads or short circuits. Positive visual indication of automatic tripped position of breaker shall be provided, in addition to the "On" and "Off" indication. All circuit breakers shall be of the bolted type.

2. TRIP RATING: Circuit breakers shall be provided with the required number of trip elements, calibrated at 40 degrees C., ambient temperature, in accordance with wire sizes or motor currents as shown on Contract Drawings or indicated in the Specifications.

3. POLE BARRIER: Multipole pole breakers shall be designed to break all poles simultaneously. They shall be provided with barriers between poles and arc suppressing devices.

4. ELEMENTS: Multipole circuit breakers shall have frames of not less than a 100 Ampere rating. Multipole circuit breakers for 480 volts AC operation shall have an NEMA interrupting rating of 18,000 Amperes, unless a higher rating is specified in the Specific Requirements or indicated on the Contract Drawings.

5. For circuit breakers with frame size up to and including 225 Amperes, the breakers may be provided with non-interchangeable trip elements. For frame ratings above 225 Amperes, the breakers shall be provided with interchangeable trip elements, which can be replaced readily.

6. Single pole circuit breakers for branch circuits shall have a frame size of no less than 100 Amperes, and shall be rated at 125 volt A.C. with a NEMA interrupting rating of 10,000 Amperes, unless a higher rating is specified in the Specifications or indicated on the Contract Drawings.

7. INVERSE TIME ACTION: The circuit breakers shall be dual element type, one (1) element with time limit characteristics, so that tripping will be prevented on momentary overloads, but will occur before dangerous values are reached and the other with instantaneous trip action. Inverse time delay action shall be effective between a minimum tripping point of 125% of rating of breaker and an instantaneous tripping point between 600% and 700% of rated current.

8. CONSTANCY OF CALIBRATION: The tripping elements shall insure constant calibration and be capable of withstanding excessive short circuit conditions without injury.

9. CONTACTS: shall be non-welding under operating conditions and of the silver to silver type.

10. TEMPERATURE RISE: Current carrying parts, except thermal elements, shall not rise in temperature in excess of 30 degrees C. while carrying rated current at rated frequency.

11. NUMBERING: Each circuit breaker shall be distinctly numbered when installed in a group with other breakers. The calibration of trip element shall be indicated on each breaker.

B. SAFETY SWITCHES:

NEMA TYPE HD: When safety switches are permitted to be used for service entrance, motor disconnecting means or to control other types of electrical equipment, they shall be of the type HD of a rating not less than 30 Amperes. Enclosures shall be provided with means for locking. For ratings above 60 Amperes terminals shall have double studs.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.6

3.6 DISTRIBUTION CENTERS:

This Section sets forth the construction and installation procedure for Switchboards, Panel boards and Cabinets.

A. PANELBOARDS-GENERAL TYPE: The panel boards shall be of the automatic circuit breaker type with individual breakers for each circuit, removable without disturbing the other units. Circuit breakers shall be in accordance with the requirements outlined under "Circuit Protective Devices."

B. NUMBER AND RATING OF CIRCUIT BREAKERS: The Contract Drawings show a layout of each panel, giving the number, frame, size and trip setting of circuit breakers and number of branch circuits and spare breakers. Each branch circuit shall be distinctly numbered.

C. BUS-BAR CONSTRUCTION AND SUPPORT: Panel Boards shall be of the dead front type and shall have bus bars and branch circuits designed to suit the system and voltage. Current carrying parts, exclusive of circuit breakers shall be copper and based on a maximum density of 1,000 Amperes per square inch. Bus bars for the main switchboard shall be designed for the frame rating of the Service Breaker. Bus bars shall run up the center of the panel, unless otherwise indicated, and shall have connected thereto the various branch circuits. Unless otherwise specified, bus bars for each panel board shall be equipped with main lugs only and capacity as required on Contract Drawings. Where main protection is required, automatic circuit breakers shall be used. A neutral bus of at least the same capacity as a live bus bar shall be provided for the connection of all neutral conductors. Each terminal shall be identified. All current carrying parts, exclusive of circuit breakers, shall be of copper with a minimum number of joints. The bus bar structure shall be a self-supporting unit, firmly fastened to a ½

inch plastic board, extending the full length and width of assembly which shall serve to insulate the bus structure from the back of panel box. Other methods affording equally effective bus structure support and insulation will be given consideration. An insulating barrier shall separate neutral bus from other parts of panel.

D. CIRCUIT BREAKER ASSEMBLY: The entire circuit breaker and bus bar assembly shall be mounted on an adjustable metal base or pan and secured to the back of panel box. The panel shall have edges flanged for rigidity.

E. PANEL MOUNTING: The panel shall be centered in the panel box to line up with door openings and set level and plumb so that no live parts are exposed with the door open.

F. PANEL CABINET:

1. PANEL CABINET INSTALLATION: When installed surface mounted in panel closets they shall be mounted on Kindorf channel.

2. Where cabinets cannot be set entirely flush due to shallow walls or partitions or where cabinet is extra deep, the protruding sides of cabinet shall be trimmed with a metal or hardwood return molding of approved design and fastened to cabinet so as to conceal the intersection between the wall and cabinet.

G. NAMEPLATES: Nameplates where required, shall be made of engraved Lamicoid sheet, or approved equal. Letters and numbers shall be engraved white on a black background (except for Firehouse projects which shall have white letters on a red background). The Contractor shall submit an engraved sample for approval as to design and style of lettering before proceeding with the manufacture of the nameplate. Nameplates shall be of suitable size and shall also be provided at the top of the switchboard or section thereof and on the trim at the top of all lighting and power panels. Similar nameplates shall also be provided for each distribution circuit breaker giving the breaker number, the number of the feeder, and the name of the equipment fed.

H. SHOP DRAWINGS: showing all details of boxes, panels, etc., shall be submitted for approval.

I. DIRECTORIES: A directory shall be fastened with brass screws and consist of a noncorrosive metal frame with dimensions not less than five (5) inches x eight (8) inches and a transparent window of Plasticile, Plexiglass, Lucite, Polycarbonate or approved equal that is not less than 1/16 inch thick over cardboard or heavy paper. The directory shall be typewritten and show the number of each circuit, the name of circuit and lighting or equipment supplied. The size of riser feeder shall be as indicated on directory. The dimensions of directory shall be submitted for approval for each size of panel.

J. CONSTRUCTION

1. FINISH: Panel boxes, doors and trim for installation in dry locations, shall be zinc coated after fabrication by the hot-dip galvanizing or electroplate process on inside and outside surfaces. In damp locations, panel boards shall be enclosed and gasketed NEMA 3R type. Panel boards located outdoors or exposed to the weather shall be NEMA 3X type.

2. PAINTING: Panel boxes, doors and trim shall receive a coat of approved priming paint and a second coat of approved paint in the field after installation. Paint shall be applied to the inside and outside of boxes and on both sides of trim. Panel trims and doors shall receive a third or finishing coat on the outside after installation. Approval as to texture and color must be obtained before the final coat is applied.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.7

3.7 MOTORS:

This Section sets forth the general design, construction and performance requirements, which shall apply to all motors furnished in the Contract.

A. MOTOR DESIGN: All motors shall be designed to comply with the New York State Energy Conservation Construction Code and the New York City Energy Conservation Code. In the event of any conflict or inconsistency between such codes, the New York City Energy Conservation Code shall prevail. Motors shall have standard NEMA frames and shall have nameplate ratings adequate to meet the specified conditions of operation. Motor performance under variable conditions of voltage and frequency shall be within the limits set in NEMA standards, unless modified in the Specifications. Motors shall be expressly designed for the hazard duty load, voltage and frequency as specified in the Contract. All motor windings shall be copper. All motors intended to operate on a 208 volt system shall be designed and rated for 200 volts.

B. STANDARDS OF COMPARISON: In the absence of specific motor specifications, in general, the best standard products of the leading motor manufacturers shall be considered as a standard for comparison. The requirements of the NEMA standards for motors and generators shall be deemed to contain the minimum requirements of performance and design.

C. OBJECTIONABLE NOISES: Objectionable noises will not be tolerated and exceptionally quiet motors may be required for certain specified locations. Noise control tests as per the New York City Construction Codes may be performed as directed by the Commissioner. Such motors shall bear a nameplate lettered "Quiet Motor." Springs and slip rings shall be of approved non-ferrous material.

D. BEARINGS:

1. Bearings, unless specified otherwise, shall be of the ball or roller type. Motors one (1) horsepower and larger that are equipped with ball roller bearings shall also have lubrication of the pressure-relief greasing type. The Contractor furnishing four (4) or more such motors shall also furnish, as part of the Contract, a pressure grease gun of rugged design, of approximately 10 ounce capacity, complete with necessary adapters. The Contractor shall also provide 10 pounds of approved gun grease.

2. For any particular unit where sleeve bearings are deemed desirable, permission for their use may be granted by the Commissioner. Motors one (1) horsepower and larger that are equipped with sleeve type bearings shall in addition to having protected accessible fittings for oiling be provided with visible means for determining normal oil level. Lubrication shall be positive, automatic and continuous.

E. MOTOR TERMINALS AND BOXES: Each motor shall be furnished with flexible leads of sufficient length to extend for a distance of not less than three (3) inches beyond the face of the conduit terminal box. This box shall be furnished of ample size to make and house motor connections. These requirements shall be met irrespective of any other standards or practices. Size of cable terminals and conduit terminal box holes shall be subject to approval. For motors five (5) horsepower. or larger, each terminal shall come with two (2) cast or forged copper pressure type connectors with bolts, nuts and washers. For motors of smaller ratings, connectors of other acceptable types may be furnished. For installations exposed to the weather or moist locations, terminal boxes shall be of cast iron with threaded hubs and gasketed covers. Cover screws shall be of non-corrosive material.

F. MOTOR TEMPERATURE RISES: The motor nameplate temperature rises for the various types of motor enclosures shall be as listed below:

1.	Open Frame	40 degrees C.
2.	Totally enclosed and enclosed fan cooled	55 degrees C.

3.	Explosion proof and submersible	55 degrees C.
4.	Partially enclosed and drip proof	40 degrees C.

The temperature of the various parts of a motor shall meet the requirements of NEMA standards for the size and type of the motors. Tests for heating shall be made by loading the motor to its rated horsepower and keeping it so loaded for the rated time interval or until the temperature becomes constant.

G. SPECIAL CODE INSTALLATIONS: Electrical installations covered by special publications of NBFU and by special City rulings and regulations shall comply in design and safety features with such applicable codes, regulations and rulings, and shall be furnished and installed complete with all accessories and safety devices as therein specified.

H. MOTORS ON LIGHTING PANELS: The largest A.C. motor permitted on branch circuits of lighting panels shall not exceed 1/4 horsepower.

I. MOTORS RATED: ½ horsepower and larger shall be polyphase.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.8

3.8 MOTOR CONTROL EQUIPMENT:

This Section sets forth the requirements for motor controllers and associated devices. Such requirements are applicable to all motor control equipment furnished or installed.

A. MANUFACTURER: All control equipment furnished under the Contract shall be the product of a single manufacturer. Exceptions to this rule may be granted in the case of controllers for fractional horsepower motors driving special equipment, the various units of which have been engineered to obtain specific performance.

B. CONTROL ITEMS REQUIRED: The Contractor furnishing motors shall also furnish therewith complete disconnecting, starting and control equipment as required by the detailed Specifications, the various code authorities and for the successful operation of the driven equipment. These items include circuit breaker, magnetic starter with overload protection and low voltage release or protection, push button stations, pilot lights and alarms, float, pressure, temperature and limit switches, load transfer switches, devices for manual operation and speed controllers, etc. The Contractor shall furnish as many of these items as are required for the successful operation of the driven unit.

1. Where a motor is to be located out of sight of the controller, the Contractor shall furnish an approved disconnecting means to be mounted near motor.

C. TYPES OF STARTERS:

1. SQUIRREL CAGE: A.C. motors of the squirrel cage type, rated from one (1) to 30 horsepower, shall have magnetic across the line starters; motors rated above 30 horsepower shall be furnished with reduced voltage (autotransformer type) starter or part winding start with time delay to reduce inrush current. Size of starters shall be based on 200V operation.

2. SLIP RING: A.C. Motors of the slip-ring type shall be furnished with primary across the line starters interlocked with secondary starting and regulating equipment. The interlocking feature shall prevent starting of the motor when the secondary controller is off the initial starting point.

3. MAGNETIC: For fractional horsepower motors, magnetic type starters are not required unless the particular method of controlling the driven equipment makes them necessary. Where individual single phase fractional horsepower motors or the sum of fractional horsepower motors controlled by an automatic device are ½ horsepower or more, magnetic starters and circuit breakers shall be used. Single phase A.C. motors smaller than ½ horsepower or three-phase A.C. motors smaller than one (1) horsepower where manual control is specified may be furnished with starters of toggle

switch or push button type with inbuilt thermal protection. No additional disconnecting means is required to be furnished with this type of starter. This type of starter may also be used in series with automatic control devices such as thermostats, float and pressure switches, provided the individual motor or the sum of fractional horsepower motors is less than ½ horsepower. Means for manual operation shall be provided.

D. DISCONNECTING BREAKER: All motor starters, unless otherwise specified, shall be provided with a disconnecting means in the form of a circuit breaker of the type specified under Article 3.5 CIRCUIT PROTECTIVE DEVICES. This disconnecting means shall be contained in the same housing with the starter and shall be operable from outside. Means shall be provided for locking the handle of the circuit breaker in the "OFF" position if it is desired to take the equipment out of service and prevent unauthorized starting.

E. CONTROL CABINET: DRY LOCATIONS - All starters shall be furnished with general purpose, NEMA Type 1, sheet metal enclosures with hinged covers and baked enamel finish.

F. CONTROL CABINET – WATERTIGHT: In wet locations, cast iron watertight enclosures with threaded hubs, galvanized and gasketed hinged covers shall be provided.

G. 1. PANELS: Motor control devices and appliances shall be mounted on approved insulating slabs with all wiring and connections made on the back of the slabs.

2. WIRING AND TERMINALS: Wiring connections for currents of 100 Amperes or less may be made with copper wire or cable with special flameproof insulating coverings. Such wires shall be installed in a neat workmanlike manner, flat against the slab, and held in place by clips. Connections shall be made with pressure connectors for No. 8 AWG and larger wires, and with grommets for small stranded wires. Except for incoming and outgoing main leads, all connections shall terminate on approved connector blocks, which may be installed on the face of the slab. For small, across the line starters, the above requirements may be modified if satisfactory connections are provided.

3. COPPER BUS: For currents exceeding 100 Amperes, copper bus shall be used in place of wires. The bus shall be constructed of copper rods, tubing or flat strap, bent and shaped properly and securely attached to the slab in a neat and workmanlike manner. The cross section of copper shall provide sufficient areas to keep current density at not more than 1,000 Amperes per square inch.

H. COOPERATION: The Contractor's subcontractor(s) who furnish electrically operated equipment shall give to the Contractor and the Contractor's electrical subcontractor full information relative to sizes and locations of apparatus furnished by them which require electrical connections.

I. SPARE PARTS:

1. FURNISH: The Contractor shall furnish the following spare parts pertaining to equipment furnished by each subcontractor.

One (1) set of contact fingers and springs and thermal elements for each three (3) (or fraction) of each size of magnetic contactor starter.

One (1) holding coil for each three (3) (or fraction) of each size of magnetic contactor starter.

2. WRAPPER MARKING: All parts shall be delivered to the Resident Engineer neatly wrapped and boxed and plainly tagged and marked for identification and reordering.

END OF SECTION 01 35 06

SECTION 01 35 26
SAFETY REQUIREMENTS PROCEDURES

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

B. The Contractor shall comply with the requirements of "*The City of New York Department of Design and Construction Safety Requirements*". This document is included in the Information for Bidders.

1.2 SUMMARY:

A. This Section includes administrative and general procedural requirements for Safety and Health Requirements, including:

1. Definitions
2. Required Safety Meeting
3. Compliance with Regulations
4. Submittals
5. Personnel Protective Equipment
6. Hazardous Materials
7. Emergency Suspension of Work
8. Protection of Personnel
9. Environmental Protection

1.3 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.4 REQUIRED SAFETY MEETINGS:

A. Prior to commencing construction, the Resident Engineer will schedule and hold a preconstruction kick-off meeting either at DDC's main office or at the Project site with representatives of the Contractor, including the principal on-site project representative and one or more safety representatives, Commissioner's designated representatives and other concerned parties for the purpose of reviewing the Contract Safety requirements. The Contractor's safety requirements shall be reviewed, and implementation of safety provisions pertinent to the Work shall be discussed.

B. The Contractor is responsible for conducting weekly documented jobsite safety meetings, given to all jobsite personnel including all subcontractors on the project, with the purpose of discussing safety topics and job specific requirements at the DDC worksite.

1.5 COMPLIANCE WITH REGULATIONS:

A. The Work, including contact with or handling of hazardous materials, disturbance or dismantling of structures containing hazardous materials, and disposal of hazardous materials, shall comply with the applicable requirement for CFR Parts 1910 and 1926, and 40 CFR, Parts 61, 261, 761 and 763.

B. Work involving disturbance or dismantling of asbestos or asbestos containing materials, demolition of structures containing asbestos and removal of asbestos, shall comply with 40 CFR Part 61, Subparts A and M, and 40 CFR Part 763, as applicable.

C. Work shall additionally comply with all applicable federal, state and local safety and health regulations.

D. In case of a conflict between applicable regulations, the more stringent requirements shall apply.

E. All workers working on the DDC project site are required by NYC Local Law 41 to complete the OSHA 10 –hour training course.

1.6 SUBMITTALS:

A. The Contractor shall submit, to the Resident Engineer, copies of the Safety Program, Site Safety Plan and other required documentation in accordance with the "*New York City Department of Design and Construction Safety Requirements.*"

B. Permits: If hazardous materials are disposed of off-site submit copies of shipping manifests and permits from applicable federal, state or local authorities and disposal facilities, and submit certificates that the material has been disposed of in accordance with regulations to the Resident Engineer.

C. Accident Reporting: Submit a copy of each accident report to the Resident Engineer in accordance with the "*New York City Department of Design and Construction Safety Requirements.*"

D. All Asbestos and Lead project regulatory notifications are to be submitted to DDC's Bureau of Environmental and Geotechnical Services (BEGS) through the Resident Engineer.

E. Request for Subcontractor Approval: Any subcontractor performing environmental work shall submit required documentation for approval to perform such work as required by DDC's BEGS.

PART II – PRODUCTS

2.1 PERSONNEL PROTECTIVE EQUIPMENT:

Special facilities, devices, equipment and similar items used by the Contractor in execution of the Work shall comply with 29 CFR Part 1910, subpart I, Part 1926, subpart E and other applicable regulations.

2.2 HAZARDOUS MATERIALS:

A. The Contractor shall bring to the attention of the Commissioner, any material encountered during execution of the Work that the Contractor suspects to be hazardous.

B. The Commissioner shall determine whether the Contractor shall perform tests to determine if the material is hazardous. A change to the Contract price may be provided, subject to the applicable provisions of the Contract.

C. If the material is found to be hazardous, the Commissioner may direct the Contractor to remediate the hazard and a change to the Contract price may be provided, subject to the applicable provisions of the Contract.

PART III – EXECUTION

3.1 EMERGENCY SUSPENSION OF WORK:

A. When the Contractor is notified by the Commissioner of noncompliance with the safety provisions of the Contract, the Contractor shall immediately, unless otherwise instructed, correct the unsafe condition, at no additional cost to the City.

B. If the Contractor fails to comply promptly, all or part of the Work may be stopped by notice from the Commissioner.

C. When, in the opinion of the Commissioner, the Contractor has taken satisfactory corrective action, the Commissioner shall provide written notice to the Contractor that work may resume.

D. The Contractor shall not be allowed any extension of time or compensation for damages in connection with a work stoppage for an unsafe condition.

3.2 PROTECTION OF PERSONNEL:

A. The Contractor shall take all necessary precautions to prevent injury to the public, occupants, or damage to property of others. The public and occupants includes all persons not employed by the Contractor or a subcontractor.

B. Whenever practical, the work area shall be fenced, barricaded or otherwise blocked off from the Public or occupants to prevent unauthorized entry into the work area, in compliance with the requirements of Section 01 50 00, TEMPORARY FACILITIES, SERVICES AND CONTROLS, and including, without limitation, the following:

1. Provide traffic barricades and traffic control signage where construction activities occur in vehicular areas.
2. Corridors, aisles, stairways, doors and exit ways shall not be obstructed or used in a manner to encroach upon routes of ingress or egress utilized by the public or occupants, or to present an unsafe condition to the public or occupants.
3. Store, position and use equipment, tools, materials, scraps and trash in a manner that does not present a hazard to the public or occupant by accidental shifting, ignition or other hazardous activity.
4. Store and transport refuse and debris in a manner to prevent unsafe and unhealthy conditions for the public and occupants. Cover refuse containers, and remove refuse on a frequent regular basis acceptable to the Resident Engineer. Use tarpaulins or other means to prevent loose transported materials from dropping from trucks or other vehicles.

3.3 ENVIRONMENTAL PROTECTION:

A. Dispose of solid, liquid and gaseous contaminants in accordance with local codes, laws, ordinances and regulations.

B. Comply with applicable federal, state and local noise control laws, ordinances and regulations, including but not limited to 29 CFR 1910.95, 29 CFR 1926.52 and NYC Administrative Code Chapter 28 of Title 15.

END OF SECTION 01 35 26

SECTION 01 35 91
HISTORIC TREATMENT PROCEDURES

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 35 91

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes administrative and procedural requirements for the treatment of Landmark Structures and Landmark Quality Structures, as identified in the Addendum. Specific requirements are indicated in other sections of the Specifications.

B. This Section includes, without limitation, the following:

1. Storage and protection of existing historic materials
2. Temporary protection of historic materials during construction
3. General Protection
4. Protection during use of heat-generating equipment
5. Photographic Documentation
6. NYC Landmarks Preservation Commission Final Approval signoffs

1.3 RELATED SECTIONS: include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 32 33 PHOTOGRAPHIC DOCUMENTATION
C. Section 01 33 00 SUBMITTAL PROCEDURES
D. Section 01 77 00 CLOSEOUT PROCEDURES
E. Section 01 78 39 CONTRACT RECORD DOCUMENTS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Landmark Structure or Site: Any building or site which has been designated as a landmark, or any building or site within a landmark district, as designated by the New York City Preservation Commission or the New York State Historic Preservation Office.

D. Landmark Quality Structure: Any building which has been determined by the City to be of landmark quality and/or historical significance.

E. Preservation: To apply measures necessary to sustain the existing form, integrity, and materials of a historic property. Work may include preliminary measures to protect and stabilize the property.

F. Rehabilitation: To make possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features that convey its historical, cultural, or architectural values.

G. Restoration: To accurately depict the form, features, and character of a property as it appeared at a particular period of time by means of the removal of features from other periods in its history and the reconstruction of missing features from the restoration period.

H. Reconstruction: To reproduce in the exact form and detail a building, structure, or artifact as it appeared at a specific period in time.

I. Stabilize: To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present.

J. Protect and Maintain: To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.

K. Repair: To stabilize, consolidate, or conserve; to retain existing materials and features while employing as little new material as possible. Repair includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials. Within restoration, repair also includes limited replacement in kind, rehabilitation, and reconstruction, with compatible substitute materials for deteriorated or missing parts of features when there are surviving prototypes.

L. Replace: To duplicate and replace entire features with new material in kind. Replacement includes the following conditions:
   1. Duplication: Includes replacing elements damaged beyond repair or missing. Original material is indicated as the pattern for creating new duplicated elements.
   2. Replacement with New Materials: Includes replacement with new material when original material is not available as patterns for creating new duplicated elements.
   3. Replacement with Substitute Materials: Includes replacement with compatible substitute materials. Substitute materials are not allowed, unless otherwise indicated.

M. Remove: To detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

N. Remove and Salvage: To detach items from existing construction and deliver them to the City ready for reuse.

O. Remove and Reinstall: To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.

P. Existing to Remain or Retain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled.

Q. Material in Kind: Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.

1.5 SUBMITTALS:

A. Historic Treatment Program: Submit a written plan for each phase or process, including protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work.

B. Alternative Methods and Materials: If alternative methods and materials to those indicated are proposed for any phase of work, submit for Commissioner's approval a written description including evidence of successful use on other comparable projects, and program of testing to demonstrate effectiveness for use on this Project.

C. Qualification Data: For historic treatment specialists as specified and required by individual sections of the project specifications.

D. Photographs for Designated Landmark Structures: Submit photographs in accordance with Section 01 32 33, PHOTOGRAPHIC DOCUMENTATION and as described in this section.

E. Record Documents: Include modifications to manufacturer's written instructions and procedures, as documented in the historic treatment preconstruction conference and as the Work progresses.

1.6 QUALITY ASSURANCE:

A. Special Experience Requirements: Special Experience Requirements may apply to the firm that will provide Historic Treatment Services. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

B. Historic Treatment Preconstruction Conference: The Resident Engineer will schedule and hold a preconstruction meeting at the site in accordance with Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION.

1. Review manufacturer's written instructions for precautions and effects of products and procedures on building materials, components, and vegetation.

   a. Record procedures established as a result of the review and distribute to affected parties.

1.7 STORAGE AND PROTECTION OF HISTORIC MATERIALS:

A. Removed and Salvaged Historic Materials: As specified and required by individual sections of the project specifications.

B. Removed and Reinstalled Historic Materials: As specified and required by individual sections of the project specifications.

C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling during historic treatment. When permitted by the Commissioner, items may be removed to a suitable, protected storage location during historic treatment and reinstalled in their original locations after historic treatment operations are complete.

D. Storage and Protection: When removed from their existing location, store historic materials, at a location acceptable to the Commissioner, within a weather tight enclosure where they are protected from wetting by rain, snow, or ground water, and temperature variations. Secure stored materials to protect from theft.

1. Identify removed items with an inconspicuous mark indicating their original location.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

3.1 PROTECTION, GENERAL:

A. Comply with manufacturer's written instructions for precautions and effects of products and procedures on adjacent building materials, components, and vegetation.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Temporary Protection of Historic Materials during Construction:

1. Protect existing materials during installation of temporary protections and construction. Do not deface or remove existing materials.
2. Attachments of temporary protection to existing construction shall be approved by the Commissioner prior to installation.

D. Protect landscape work adjacent to or within work areas as follows:

1. Provide barriers to protect tree trunks.
2. Bind spreading shrubs.
3. Use coverings that allow plants to breathe and remove coverings at the end of each day. Do not cover plant material with a waterproof membrane for more than 8 hours at a time.
4. Set scaffolding and ladder legs away from plants.

E. Existing Drains: Prior to the start of work or any cleaning operations, test drains and other water removal systems to ensure that drains and systems are functioning properly. Notify Commissioner immediately of drains or systems that are stopped or blocked. Do not begin Work of this Section until the drains are in working order.

1. Provide a method to prevent solids, including stone or mortar residue, from entering the drains or drain lines. Clean out drains and drain lines that become blocked or filled by sand or any other solids because of work performed under this Contract.
2. Protect storm drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION DURING USE OF HEAT-GENERATING EQUIPMENT:

A. No roofing work requiring the use of an open flame shall be permitted on any Landmark Structure or any Landmark Quality Structure, whose roof or wall structure is made of wood or primarily of wood.

B. Comply with the following procedures while performing work with heat-generating equipment, including welding, cutting, soldering, brazing, paint removal with heat, and other operations where open flames or implements utilizing heat are used:

1. Obtain Commissioner's approval for operations involving use of open-flame or welding equipment. Notification shall be given for each occurrence and location of work with heat-generating equipment.
2. As far as practical, use heat-generating equipment in shop areas or outside the building.
3. Before work with heat-generating equipment commences, furnish personnel to serve as a fire watch (or watches) for location(s) where work is to be performed.

4. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.

5. Remove and keep the area free of combustibles, including, rubbish, paper, waste, etc., within area of operations.

6. If combustible material cannot be removed, provide fireproof blankets to cover such materials.

7. Where possible, furnish and use baffles of metal or gypsum board to prevent the spraying of sparks or hot slag into surrounding combustible material.

8. Prevent the extension of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.

9. Inspect each location of the day's work not sooner than 30 minutes after completion of operations to detect hidden or smoldering fires and to ensure that proper housekeeping is maintained.

C. Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to automatic sprinkler heads, shield the individual heads temporarily with guards.

3.3 PHOTOGRAPHIC DOCUMENTATION:

Photographs for Designated Landmark Structures: Show existing conditions prior to any historic treatments, including one overall photograph and two close-up photographs of all areas of work affected. Show one overall photograph and two close-up photographs of all areas of work after the successful execution of all historical treatments.

3.4 NEW YORK CITY LANDMARKS PRESERVATION COMMISSION FINAL APPROVALS SIGNOFF:

For all projects involving a Landmark Structure or Site, the Contractor, at the completion of the work, shall submit to the Commissioner, in accordance with Section 01 78 39, CONTRACT RECORD DOCUMENTS, all documentation concerning the successful execution of all historic treatments. This shall include, but not be limited to, copies of all before and after photographs of historic treatments, one copy of the Contractor's as-built drawings, copies of testing and analysis results, including cleaning, mortar analysis, pointing mortars and all other information pertaining to work performed under the New York City Landmarks Preservation Commission jurisdiction.

END OF SECTION 01 35 91

SECTION 01 40 00
QUALITY REQUIREMENTS

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes the following:
   a. Definitions
   b. Conflicting Requirements
   c. Quality Assurance
   d. Quality Control
   e. Approval of Materials
   f. Special Inspections (Controlled Inspection)
   g. Inspections by Other City Agencies
   h. Certificates of Approval
   i. Acceptance Tests
   j. Repair and Protection

B. This Section includes administrative and procedural requirements for quality control to assure compliance with quality requirements specified in the Contract Documents.

C. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

D. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

E. Provisions of this Section do not limit requirements for the Contractor to provide quality-assurance and -control services required by the Commissioner or authorities having jurisdiction.

F. Specific test and inspection requirements are specified in the individual sections of the Specifications.

G. LEED: Refer to the Addendum to identify whether this project is designed to comply with a Certification Level according to the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Rating System, as specified in Section 01 81 13, "SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS."

H. COMMISSIONING: Refer to the Addendum to identify whether this project will be Commissioned by an independent third party under separate contract with the City of New York. Commissioning shall be in accordance with ASHRAE and USGBC LEED-NC procedures, as described in Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS. The Contractor shall cooperate with the commissioning agent and provide whatever assistance is required.

1.3 RELATED SECTIONS: Include without limitation the following:

A.	Section 01 10 00	SUMMARY
B.	Section 01 31 00	PROJECT MANAGEMENT AND COORDINATION
C.	Section 01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
D.	Section 01 33 00	SUBMITTAL PROCEDURES
E.	Section 01 77 00	CLOSEOUT PROCEDURES
F.	Section 01 78 39	CONTRACT RECORD DOCUMENTS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Commissioning: A Total Quality Assurance process that includes checking the design and installation of equipment, as well as performing functional testing of the same to confirm that the installed equipment is operating and in conformance with the Contract Documents and the City's requirements.

1.5 CONFLICTING REQUIREMENTS:

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, the Contractor shall comply with the most stringent requirement as determined by the Commissioner. The Contractor shall refer any uncertainties and/or conflicting requirements to the Commissioner for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. The Contractor shall refer any uncertainties to the Commissioner for a decision before proceeding.

1.6 QUALITY ASSURANCE:

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required. Individual Specification Sections specify additional requirements.

B. Installer Qualifications: Special Experience Requirements may apply to the firm that will install, erect or assemble specified work required for the Project. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

C. Manufacturer Qualifications: Special Experience Requirements may apply to the firm that will manufacture equipment, products or systems specified for the Project. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

D. Fabricator Qualifications: Special Experience Requirements may apply to the firm that will fabricate material, products or systems specified for the Project. If applicable, such Special Experience Requirements are set forth in the Bid Booklet and the Addendum.

E. Professional Engineer Qualifications: A professional engineer who is licensed to practice in the State of New York and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by the Resident Engineer.
2. Notify Resident Engineer seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Design Consultant's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise directed or indicated.

1.7 QUALITY CONTROL:

A. City's Responsibilities: Where quality-control services are indicated as the City's responsibility in the Specifications, the City will engage a qualified testing agency to perform these services.

1. COST OF TESTS BORNE BY THE CITY: Where the City directs tests to be performed to determine compliance with the Specifications regarding materials or equipment, and where such compliance is ascertained as a result thereof, the City will bear the cost of such tests.
2. The City will furnish the Contractor with names, addresses, and telephone numbers of testing entities engaged and a description of the types of testing and inspecting they are engaged to perform.
3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to the Contractor.

B. Contractor's Responsibility: Tests and inspections not explicitly assigned to the City are the Contractor's responsibility. Unless otherwise indicated, the Contractor shall provide quality-control services as set forth in the Specifications and those required by Authorities having jurisdiction. The Contractor shall provide quality-control services required by Authorities having jurisdiction, whether specified or not.

1. COST OF TESTS BORNE BY CONTRACTOR – In the case of tests which are specifically called for in the Specifications to be provided by the Contractor or tests which are required by any Authority having jurisdiction, but are not indicated as the responsibility of the City, the cost thereof shall be borne by the Contractor and shall be deemed to be included in the Contract price. The Contractor shall reimburse the City for expenditures incurred in providing tests on materials and equipment submitted by the Contractor as the equivalent of that specifically named in the Specifications and rejected for non-compliance.
2. Where services are indicated as Contractor's responsibility, the Contractor shall engage a qualified testing agency to perform these quality-control services. Any testing agency engaged by the Contractor to perform quality control services is subject to prior approval by the Commissioner.

3. The Contractor shall not employ same entity engaged by the City, unless agreed to in writing by the Commissioner.
4. The Contractor shall notify testing agencies and the Resident Engineer at least 72 hours in advance of the date and time for the performance of Work that requires testing or inspecting.
5. Where quality-control services are indicated as Contractor's responsibility, the Contractor shall submit a certified written report, in triplicate to the Commissioner, of each quality-control service.
6. Testing and inspecting requested by the Contractor and not required by the Contract Documents are Contractor's responsibility.
7. The Contractor shall submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, the Contractor shall engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Results shall be submitted in writing as specified in Section 01 33 00 SUBMITTAL PROCEDURES.

D. Retesting/Re-inspecting: Regardless of whether the original tests or inspections were the Contractor's responsibility, the Contractor shall provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Associated Services: The Contractor shall cooperate with entities performing required tests, inspections, and similar quality-control services, and shall provide reasonable auxiliary services as requested. The Contractor shall notify the testing agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist testing entity in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing entities.
6. Design mix proposed for use for material mixes that require control by the testing entity.
7. Security and protection for samples and for testing and inspecting equipment at the Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

2. Coordinate and cooperate with the Commissioning Authority/Agent as applicable for start-up, inspection and functional testing in the implementation of the Commissioning Plan.

G. Manufacturer's Directions: Where the Specifications provide that the manufacturer's directions are to be used, such printed directions shall be submitted to the Commissioner.

H. Inspection of Material: In the event that the Specifications require the Contractor to engage the services of an entity to witness and inspect any material especially manufactured or prepared for use in or part of the permanent construction, such entity shall be subject to prior written approval by the Commissioner.

1. NOTICE - The Contractor shall give notice in writing to the Commissioner sufficiently in advance of its intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the Commissioner will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials, or the Commissioner will notify the Contractor that the inspection will be made at a point

other than the point of manufacture, or the Commissioner will notify the Contractor that inspection will be waived.

I. No Shipping Before Inspection: The Contractor shall comply with the foregoing before shipping any material.

J. Certificate of Manufacture: When the Commissioner so requires, the Contractor shall furnish to the Commissioner authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Specifications. These certificates shall include copies of the results of physical tests and chemical analyses where necessary, that have been made directly on the product, or on similar products being fabricated by the manufacturer. This may include such approvals as B.S.A., M.E.A., B.E.C. Advisory Board, etc.

K. Acceptance: When materials or manufactured products shall comprise such quantity that it is not practical to make physical tests or chemical analyses directly on the product furnished, a certificate stating the results of such tests or analyses of similar materials which were concurrently produced may, at the discretion of the Commissioner, be considered as the basis for the acceptance of such material or manufactured product.

L. Testing Compliance: The testing personnel shall make the necessary inspections and tests, and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Specifications, indicating thereon all analyses and/or test data and interpreted results thereof.

M. Reports: Six (6) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Commissioner as a prerequisite for the acceptance of any material or equipment.

N. Rejections: If, in making any test, it is ascertained by the Commissioner that the material or equipment does not comply with the Specifications, the Contractor will be notified thereof, and will be directed to refrain from delivering said materials or equipment, or to promptly remove it from the site or from the work and replace it with acceptable material at no additional cost to the City.

O. Furnish Designated Materials: Upon rejection of any material or equipment submitted as the equivalent of that specifically named in the Specifications, the Contractor shall immediately proceed to furnish the designated material or equipment.

1.8 APPROVAL OF MATERIALS:

A. Local Laws: All materials, appliances and types or methods of construction shall be in accordance with the Specifications and shall in no event be less than that necessary to conform to the requirements of the New York City Construction Codes, Administrative Code and Charter of the City of New York.

B. Approval of Manufacturer: The names of proposed manufacturers, material suppliers, and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Commissioner for approval, as early as possible, to afford proper review and analysis. No manufacturer will be approved for any materials to be furnished under the Contract unless it shall have a plant of ample capacity and shall have successfully produced similar products. All approvals of materials or equipment that are legally required by the New York City Construction Codes and other governing Authorities must be obtained prior to installation.

C. All Materials: Fixtures, fittings, supplies and equipment furnished under the Contract shall be new and unused, except as approved by the Commissioner, and of standard first-grade quality and of the best workmanship and design. The City of New York encourages the use of recycled products where practical.

D. INFORMATION TO SUPPLIERS - In asking for prices on materials under any item of the Contract, the Contractor shall provide the manufacturer or dealer with such complete information from the

Specifications and Contract Drawings as may in any case be necessary, and in every case the Contractor shall inform the manufacturer or dealer of all the General Conditions and requirements herein contained.

1.9 SPECIAL INSPECTIONS:

A. SPECIAL INSPECTIONS:

1. Inspection of selected materials, equipment, installation, fabrication, erection or placement of components and connections made during the progress of the Work to ensure compliance with the Contract Documents and provisions of the New York City Construction Codes, shall be made by a Special Inspector. The City of New York will retain the services of the Special Inspector and bear the costs for the performance of Special Inspections in compliance with NYC Construction Codes requirements or as additionally may be called for in the project specifications, except as noted below for Form TR-3: Technical Report for Concrete Design Mix. The Special Inspector shall be an entity compliant with the requirements of the New York City Construction Codes. The Contractor shall notify the relevant Special Inspector in writing at least 72 hours before the commencement of any work requiring special inspection.
2. Form TR3: Technical Report Concrete Design Mix: The contractor shall be responsible for, and bear all costs associated with the filing and securing of approvals, if any, for Form TR3: Technical Report Concrete Design Mix, including, but not limited to, engaging the services of a New York City licensed Concrete Testing Lab for the review and approval of concrete design mix, testing, signatures and professional seals, etc., compliant with NYC Department of Buildings requirements, for each concrete design mix.
3. The Contractor shall notify the relevant Special Inspector in writing at least 72 hours before the commencement of any work requiring Special Inspection. The contractor shall be responsible for, and bear related costs to assure that all construction or work shall remain accessible and exposed for inspection purposes until the required inspection is completed.
4. Inspections and tests performed under "Special Inspection" shall not relieve the Contractor of the responsibility to comply with the Contract Documents, and that there is no warranty given to the Contractor by the City of New York in connection with such inspection and tests or certifications made under "Special Inspections".
5. The contractor must coordinate with the Resident Engineer or DDC Project Manager to provide access and schedule the work for inspection by the Special Inspector.

1.10 INSPECTIONS BY OTHER CITY AGENCIES:

A. Letter of Completion: Just prior to substantial completion of this Project, the Commissioner will file with the Department of Buildings, an application for a Letter of Completion or a Certificate of Occupancy for the structure.

B. Final Inspections: In connection with the above mentioned application for a Letter of Completion or a Certificate of Occupancy and before certificates of final payments are issued, the Contractor will be required to arrange for all final inspections by the inspection staff of the Department of Buildings, Fire Department or other Governmental Agencies having jurisdiction, and secure all reports, sign offs, certificates, etc., by such inspection staff or other governmental agencies, in order that a Letter of Completion or Certificate of Occupancy can be issued promptly.

1.11 CERTIFICATES OF APPROVAL:

A. Responsibility: The Contractor shall be responsible for and shall obtain all final approvals for the work installed under the Contract in the form of such certificates that are required by all governmental agencies having jurisdiction over the work of the Contract.

B. Transmittal: All such certificates shall be forwarded to the Commissioner through the Resident Engineer.

1.12 ACCEPTANCE TESTS:

A. Government Agencies: All equipment and appliances furnished and installed under the Contract shall conform to the requirements of the Specifications, and shall in no event be less than that necessary to comply with the minimum requirements of the law and all of the governmental agencies having jurisdiction.

B. Notice of Tests: Whenever the Specifications and/or any governmental agency having jurisdiction requires the acceptance test, the Contractor shall give written notice to all concerned of the time when these tests will be conducted.

C. Energy: The City will furnish all energy, fuel, water and light required for tests.

D. Labor and Materials: The Contractor shall furnish labor and all other material and instruments necessary to conduct the acceptance tests at no additional cost to the City.

E. Certificates: The final acceptance by the Commissioner shall be contingent upon the Contractor delivering to the Commissioner all necessary certificates evidencing compliance in every respect with the requirements of the regulatory agencies having jurisdiction.

F. Results: If the results of tests and Special Inspections indicate that the material or procedures do not meet requirements as set forth on the Contract Drawings or in the Specifications or are otherwise unsatisfactory, the Contractor shall only proceed as directed by the Resident Engineer. Additional costs resulting from retesting, re-inspecting, replacing of material and/or damage to the work and any delay caused to the schedule shall be borne by the Contractor.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, the Contractor shall repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

END OF SECTION 01 40 00

SECTION 01 42 00
REFERENCES

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 DEFINITIONS:

REFER TO THE ADDENDUM, Article IX, FOR ADDITIONAL DEFINITIONS AND REVISIONS TO THE CONTRACT AND SPECIFICATIONS

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. "APPROVED," ETC. - "Approved," "acceptable," "satisfactory," and words of similar import shall mean and intend approved, acceptable or satisfactory to the Commissioner.

C. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

D. "DIRECTED," "REQUIRED," ETC.- Wherever reference is made in the Contract to the work or its performance, the terms "directed," "required," "permitted," "ordered," "designated," "prescribed," "determined," and words of similar import shall, unless expressed otherwise, imply the direction, requirements, permission, order, designation or prescription of the Commissioner.

E. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings.

1.3 CODES, AGENCIES AND REGULATIONS:

A.D.A.A.G.	Americans with Disabilities Act (ADA) – Architectural Barriers Act (ABA)
B.G. & E.	Bureau of Gas and Electricity of the City of New York
B.S. & A.	New York City Board of Standards and Appeals
DOE	Department of Energy
E.C.C.C.N.Y.S.	Energy Conservation Construction Code of New York State
EPA	Environmental Protection Administration
N.Y.C.C.C.	New York City Construction Codes – includes:
	New York City Plumbing Code
	New York City Building Code
	New York City Mechanical Code
	New York City Fuel Gas Code
N.Y.S.D.O.L	New York State Department of Labor
N.Y.C.D.E.P	New York City Department of Environmental Protection
N.Y.C.E.C.	New York City Electrical Code
N.Y.C.E.C.C	New York City Energy Conservation Code
N.Y.C.F.C	New York City Fire Code
N.Y.S...D.E.C.	New York State Department of Environmental Conservation
O.S.H.A.	Occupational Safety & Health Administration

1.4 INDUSTRY STANDARDS:

A. STANDARD REFERENCES – Unless otherwise specifically indicated in the Contract Documents, whenever reference is made to the furnishing of materials or testing thereof that conforms to the standards of any technical society, organization or body, it shall be construed to mean the latest standard, code, specification adopted and published by that technical society, organization or body, as of the date of the bid opening, Unless the provisions of the New York City Construction Codes adopts a different or earlier dated version of such standard.

B. APPLICABILITY OF STANDARDS: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect, to the extent referenced, as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.

C. CONFLICTING REQUIREMENTS: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantity or quality, comply with the most stringent requirements. Immediately refer uncertainties, and requirements that are different but apparently equal, to the Commissioner in writing for a decision before proceeding.

D. STANDARD SPECIFICATIONS - When no reference is made to a code, standard or specification, the Standard Specifications of the ASTM or the AIEE, as the case may be, shall govern.

E. REFERENCES - Reference to a technical society, organization or body may be made in the Specifications by abbreviations. Abbreviations and acronyms used in the Specifications and other Contract Documents mean the associated name. The following names are subject to change and are

believed, but are not assured, to be accurate and up-to-date as of the Issue Date of the Contract Documents.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists (The)
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	ACI International (American Concrete Institute)
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AGMA	American Gear Manufacturer Association
AHA	American Hardboard Association (Now part of CPA)
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)

ALSc	American Lumber Standard Committee, Incorporated
ALI	Automotive Lift Institute
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	APA - The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASA	American Standards Association
ASAE	American Society of Agricultural Engineers
ASCE/SEI	American Society of Civil Engineers, Structural Engineering Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	AWCI International (Association of the Wall and Ceiling Industry International)
AWCMA	American Window Covering Manufacturers Association (Now WCSC)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWSC	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)

BICSI	BICSI
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
CIBSE	Charted Institute of Building Services Engineers
CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CGSB	Canadian General Standards Board
CIMA	Cellulose Insulation Manufacturers Association
CIPRA	Cast Iron Pipe Research Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CPSC	Consumer Product Safety Commission
CRI	Carpet & Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)

DASMA	Door and Access Systems Manufacturer's Association International
DHI	Door and Hardware Institute
DOC	U.S. Department of Commerce – National Institute of Standards and Technology
EIA	Electronic Industries Alliance
DOJ	U.S. department of Justice
EIMA	EIFS Industry Members Association
DOL	U.S. Department of labor
EJCDC	Engineers Joint Contract Documents Committee
DOTn	U.S. Department of Transportation
EN	European Committee of Standards
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association
EVO	Efficiency Valuation Organization
FEME	Federal Emergency Management Agency
FIBA	Federation Internationale de Basketball Amateur (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FMG	FM Global (Formerly: FM - Factory Mutual System)
FMRC	Factory Mutual Research (Now FMG)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Now GSI)
GS	Green Seal
GSI	Geosynthetic Institute

HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
HUD	U.S. Department of Housing and Urban Development
IAPMO	International Association of Plumbing and Mechanical Officials
IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation
ICC	International Code Council, Inc.
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association

MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council

NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NIS	National Institute of Standards and Technology
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)
NWWDA	National Wood Window and Door Association (Now WDMA)
OPL	Omega Point Laboratories, Inc. (Acquired by ITS - Intertek)
PCI	Precast / Pre-stressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)
PPS	Power Piping Society
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
RMI	Rack Manufacturers Institute
RTI	(Formerly: NTRMA - National Tile Roofing Manufacturers Association) (Now TRI)

SAE	SAE International
SCAQMD	South Coast Air Quality Management District
SCS	Scientific Certification System
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SGCC	Safety Glazing Certification Council
SHBI	Steel Heating Boiler Institute
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society

TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute (Formerly: RTI - Roof Tile Institute)
UL	Underwriters Laboratories Inc.
ULC	Underwriters Laboratories of Canada
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USC	United States Code
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association (Now WCSC)
WCSC	Window Covering Safety **Council** (Formerly: WCMA - Window Covering Manufacturers Association)
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WRI	Wire Reinforcement Institute, Inc.
USEPA	United States Environmental Protection Agency
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00
TEMPORARY FACILITIES, SERVICES AND CONTROLS

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This section includes the following:
   a. Temporary Water System
   b. Temporary Sanitary Facilities
   c. Temporary Electric Power, Temporary Lighting System, And Site Security Lighting
   d. Temporary Heat
   e. Dewatering Facilities And Drains
   f. Temporary Field Office for Contractor
   g. Resident Engineer's Office
   h. Material Sheds
   i. Temporary Enclosures
   j. Temporary Partitions
   k. Temporary Fire Protection
   l. Work Fence Enclosure
   m. Rodent and Insect Control
   n. Plant Pest Control Requirements
   o. Project Identification Signage
   p. Security Guards/Fire Guards on Site
   q. Project Sign and Rendering
   r. Safety

1.3 RELATED SECTIONS: include without limitation the following:

A.	Section 01 10 00	SUMMARY
B.	Section 01 42 00	REFERENCES
C.	Section 01 54 11	TEMPORARY ELEVATORS AND HOISTS
D.	Section 01 54 23	TEMPORARY SCAFFOLDS AND SWING STAGING
E.	Section 01 77 00	CLOSE OUT PROCEDURES

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Permanent Enclosure: As determined by Commissioner, permanent or temporary roofing that is complete, insulated, and weather tight; exterior walls which are insulated and weather tight; and all openings that are closed with permanent construction or substantial temporary closures.

C. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.5 SUBMITTALS:

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Reports: Submit reports of tests, inspections, meter readings and similar procedures for temporary use.

1.6 PROJECT CONDITIONS:

A. Temporary Use of Permanent Facilities and Services: The Contractor shall be responsible for the operation, maintenance, and protection of each permanent facility and service during its use as a construction facility before Final Acceptance by the City, regardless of previously assigned responsibilities.

B. Install, operate, maintain and protect temporary facilities, services and controls.
1. Keep temporary services and facilities clean and neat in appearance.
2. Operate temporary services in a safe and efficient manner.
3. Relocate temporary services and facilities as needed as Work progresses.
4. Do not overload temporary services and facilities or permit them to interfere with progress.
5. Provide necessary fire prevention measures.
6. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on-site.

1.7 NON-REGULAR WORK HOURS (OVERTIME):

A. The Contractor shall provide the temporary services, facilities and controls set forth in this Section during other than regular working hours if the Drawings and/or the Specifications indicate that the Work, or specific components thereof, must be performed during other than regular working hours. In such case, all costs for the provision of temporary services, facilities and controls during other than regular working hours shall be deemed included in the total Contract Price.

B. The Contractor shall provide the temporary services, facilities and controls set forth in this Section during other than regular working hours if a change order is issued directing the Contractor to perform the Work, or specific components thereof, during other than regular working hours. In such case, compensation for the provision of temporary services, facilities and controls during other than regular working hours shall be provided through the change order.

1.8 SERVICES BEYOND COMPLETION DATE:

A. The Contractor shall provide the temporary services, facilities and controls set forth in this Section until the date on which it completes all required work at the site, including all punch list work, as certified in writing by the Resident Engineer, or earlier if so directed in writing by the Commissioner. The Contractor shall provide such temporary services, facilities and controls even if completion of all required work at the site occurs after the time fixed for such completion in Schedule A.

PART II – PRODUCTS

2.1 MATERIALS:

A. Provide undamaged materials in serviceable condition and suitable for use intended.
B. Tarpaulins: Waterproof, fire-resistant UL labeled with flame spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
C. Water: Potable and in compliance with requirements of the Department of Environmental Protection.

2.2 EQUIPMENT:

A. Provide undamaged equipment in serviceable condition and suitable for use intended.
B. Water Hoses: Heavy-duty abrasive-resistant flexible rubber hoses, 100 feet (30 m) long with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
C. Electric Power Cords: Grounded extension cords.
   1. Provide hard-service cords where exposed to abrasion or traffic.
   2. Provide waterproof connectors to connect separate lengths of electric cords where single lengths will not reach areas of construction activity.
   3. Do not exceed safe length-voltage ratio.
D. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART III –EXECUTION:

3.1 INSTALLATION, GENERAL:

A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities as approved by the Resident Engineer.

3.2 TEMPORARY WATER SYSTEM:

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.2 A

A. TEMPORARY WATER SYSTEM - NEW FACILITIES: During construction, the Contractor shall furnish a Temporary Water System as set forth below.
   1. Immediately after the Commissioner has issued an order to start work, the Contractor shall file an application with the Dept. of Environmental Protection for the schedule of charges for water use during construction. The Contractor will be responsible for payment of water charges.
   2. Immediately after the Commissioner has issued an order to start work, the Contractor shall file an application with the Department of Environmental Protection's Bureau of Water Supply and obtain a permit to install the temporary water supply system. The system shall be installed and maintained for the use of the Contractor and its subcontractors. A copy of the above mentioned permit shall be filed with the Commissioner. The Contractor shall provide temporary water main, risers and waste stacks as directed and install on each floor, outlets with two (2) 3/4" hose valve connections over a barrel installed on a steel pan. The Contractor shall provide drains from the pans to the stack and house sewer and hose bibs to drain the water supply

risers and mains. During winter months, the Contractor shall take the necessary precautions to prevent the temporary water system from freezing. The Contractor shall provide repairs to the temporary water supply system for the duration of the project until said temporary system is dismantled and removed.

3. Disposition of Temporary Water System: The Contractor shall be responsible for dismantling the temporary water system when no longer required for the construction operations, or when replaced by the permanent water system installed for the project, or as otherwise directed by the Resident Engineer. All repair work resulting from the dismantling of the temporary water system shall be the responsibility of the Contractor.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.2 B

B. TEMPORARY WATER SYSTEM – PROJECTS IN EXISTING FACILITIES:
   1. When approved by the Commissioner, use of existing water system will be permitted for temporary water service during construction, as long as the system is cleaned and maintained in a condition acceptable to the Commissioner. At Substantial Completion, the Contractor shall restore the existing water system to conditions existing before initial use.
   2. The Contractor shall be responsible for all repairs to the existing water system permitted to be used for temporary water service during construction. The Contractor shall be responsible to maintain the existing system in a clean condition on a daily basis, acceptable to the Commissioner.
   3. The Contractor will be responsible for payment of water charges as directed by the Commissioner. Billing will be in accordance with the Department of Environmental Protection schedule of charges for Building Purposes.

C. WASH FACILITIES: The Contractor shall install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition.
   1. Dispose of drainage properly.
   2. Supply cleaning compounds appropriate for each condition.
   3. Include safety showers, eyewash fountains and similar facilities for the convenience, safety and sanitation of personnel.

D. DRINKING WATER FACILITIES: The Contractor shall provide drinking water fountains or containerized tap-dispenser bottled-drinking water units, complete with paper cup supplies. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg. F (7 to 13 deg. C).

3.3 TEMPORARY SANITARY FACILITIES:

A. The Contractor shall provide toilets, wash facilities and drinking water fixtures in compliance with regulations and health codes for type, number, location, operation and maintenance of fixtures and facilities. Provide toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility, and provide covered waste containers for used materials.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.3 B

B. SELF-CONTAINED TOILET UNITS:
   1. The Contractor shall provide temporary single-occupant toilet units of the chemical, aerated re-circulation, or combustion type for use by all construction personnel. Units shall be properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Quantity of toilet units shall comply with the latest OSHA regulations.
   2. Toilets: Install separate self-contained toilet units for male and female personnel. Shield toilets to ensure privacy.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.3 C

C. EXISTING TOILETS:

1. TOILET FACILITIES: When approved by the Commissioner, the Contractor shall arrange for the use of existing toilet facilities by all personnel during the execution of the work. The Contractor shall be responsible to clean and maintain facilities in a condition acceptable to the Resident Engineer and, at completion of construction, to restore facilities to their condition at the time of initial use.
2. MAINTENANCE - The Contractor shall maintain the temporary toilet facilities in a clean and sanitary manner and make all necessary repairs.
3. NUISANCES - The Contractors shall not cause any sanitary nuisance to be committed by its employees or the employees of its subcontractors in or about the work, and shall enforce all sanitary regulations of the City and State Health Authorities.

3.4 TEMPORARY ELECTRIC POWER, TEMPORARY LIGHTING SYSTEM, AND SITE SECURITY LIGHTING:

A. SCOPE: This Section sets forth the General Conditions and procedures relating to Temporary Electric Power, Temporary Lighting System and Site Security Lighting during the construction period.

B. TEMPORARY ELECTRIC POWER:
The Contractor shall provide and maintain a Temporary Electric Power service and distribution system of sufficient size, capacity and power characteristics required for construction operations for all required work by the Contractor and its subcontractors, including but not limited to power for the Temporary Lighting System, Site Security Lighting, construction equipment, hoists, temporary elevators and all field offices. Temporary Electric Power shall be provided as follows:

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4 B (1)

1. CONNECTION TO UTILITY LINES:
   a. Temporary Electric Power Service for use during construction shall be provided as follows: The Contractor shall make all necessary arrangements with the Public Utility Company and pay all charges for the Temporary Electric Power system. The Contractor shall include in its total Contract Price any charges for Temporary Electric Power, including charges that may be made by the Public Utility Company for extending its electrical facilities, and for making final connections. The Contractor shall make payment directly to the Public Utility Company.
   b. APPLICATIONS FOR METER: The Contractor shall make application to the Public Utility Company and sign all documents necessary for, and pay all charges incidental to, the installation of a watt hour meter or meters for Temporary Electric Power. The Contractor shall pay to the Public Utility Company, all bills for Temporary Electric energy used throughout the work, as they become due.
   c. SERVICE AND METERING EQUIPMENT - The Contractor shall furnish and install, at a suitable location on the site, approved service and metering equipment for the Temporary Electric Power System, ready for the installation of the Public Utility Company's metering devices. The temporary service mains to and from the metering location shall be not less than 100 Amperes, 3-phase, 4-wire and shall be of sufficient capacity to take care of all demands for all construction operations and shall meet all requirements of the NYCEC.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4 B (2)

2. CONNECTION TO EXISTING ELECTRICAL POWER SERVICE:
   a. When approved by the Commissioner, electrical power service for the Temporary Lighting System and for the operation of small tools and equipment less than ¼ horsepower may be taken from the existing electric distribution system if the existing system is of adequate capacity for the temporary power load. The Contractor shall cooperate and coordinate with the facility custodian, so as not to interfere with the normal operation of the facility.
   b. There will be no charge to the Contractor for the electrical energy consumed.
   c. The Contractor shall provide, maintain and pay all costs for separate temporary electric power for any temporary power for equipment larger than 1/4 horsepower. When directed by the Commissioner, the Contractor shall remove its own temporary power system.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4 B (3)

3. ELECTRICAL GENERATOR POWER SERVICE:
   a. When connection to Utility Lines or existing facility electric service is not available or is not adequate to supply the electric power need for construction operations, the Contractor shall provide self-contained generators to provide power beyond that available.
   b. Pay for all energy consumed in the progress of the Work, exclusive of that available from the existing facility or Utility Company.
   c. Provide for control of noise from the generators.
   d. Comply with the Ultra Low Sulfur Fuel in Non-Road Vehicles requirements as set forth in Article 5.4 of the Contract.

C. USE OF COMPLETED PORTIONS OF THE ELECTRICAL WORK:
   1. USE OF MAIN DISTRIBUTION PANEL: As soon as the permanent electric service feeders and equipment, metering equipment and main distribution panel are installed and ready for operation, the Contractor shall have the temporary lighting and power system changed over from the temporary service points to the main distribution panel.
   2. COST OF CHANGE OVER - The Contractor shall be responsible for all costs due to this change over of service and it shall also make application to the Public Utility Company for a watt hour meter to be set on the permanent meter equipment.
   3. The requirements for temporary electric power service specified herein shall be adhered to after change over of service until final acceptance of the project.
   4. NO EXTRA COST - The operation of the service and switchboard equipment shall be under the supervision of the Contractor, but this shall in no way be interpreted to mean the acceptance of such part of the installation or relieve the Contractor from its responsibility for the complete work or any part thereof. There shall be no additional charge for supervision by the Contractor.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4 D

D. TEMPORARY LIGHTING SYSTEM:
   1. The Contractor shall provide adequate service for the temporary lighting system, or a minimum of 100 Amperes, 3-phase, 4-wire service for the temporary lighting system, whichever is

greater, and make all necessary arrangements with the Public Utility Company and pay all charges by them for the Temporary Lighting System

2. The Contractor shall furnish and connect to the metered service point, a Temporary Lighting System to illuminate the entire area where work is being performed and points adjacent to the work, with separately fused circuits for stairways and bridges. Control switches for stairway circuits shall be located near entrance on ground floor.
3. ITEMS: The Temporary Lighting System provided by the Contractor shall consist of wiring, fixtures, left-hand double sockets, (one (1) double socket for every 400 square feet, with one (1) lamp and one (1) three-prong outlet) lamps, fuses, locked type guards, pigtails and any other incidental material. Additional details may be outlined in the detailed Specifications for the Electrical Work. Changes may be made, provided the full equivalent of those requirements is maintained.
4. The Temporary Lighting System shall be progressively installed as required for the advancement of the work under the Contract.
5. RELOCATION: The cost for the relocation or extension of the original Temporary Lighting System, required by the Contractor or its subcontractors, that is not required due to the normal advancement of the work, as determined by the Resident Engineer, shall be borne by the Contractor.
6. PIGTAILS: shall be furnished with left-hand sockets with locked type guards and 40 feet of rubber covered cable. The Contractor shall furnish and distribute a minimum of three (3) complete pigtails to each subcontractor. See the detailed Electrical Specifications for possible additional pigtails required.
7. LAMPS: The Contractor shall furnish and install one (1) complete set of lamps, including those for the trailers. Broken and burned out lamps in the temporary lighting system, DDC field office and construction trailers, shall be replaced by the Contractor. All lamps shall be compact fluorescent.
8. CIRCUIT PROTECTION: The Contractor shall furnish and install GFI protection for the Temporary Lighting and Site Security Lighting Systems.
9. MAINTENANCE OF TEMPORARY LIGHTING SYSTEM:
   a. The Contractor shall maintain the Temporary Lighting System in good working order during the scheduled hours established.
   b. The Contractor shall include in its total Contract Price all costs in connection with the Temporary Lighting System, including all costs for installation, maintenance and electric power.
10. REMOVAL OF TEMPORARY LIGHTING SYSTEM: The temporary lighting system shall be removed by the Contractor when authorized by the Commissioner.
11. HAND TOOLS: The temporary lighting system shall not be used for power purposes, except that light hand tools not larger than 1/4 horsepower may be operated from such system by the Contractor and its subcontractors.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4 E

E. SITE SECURITY LIGHTING (FOR NEW CONSTRUCTION ONLY):

1. The Contractor shall furnish, install and maintain a system of site security lighting, as herein specified, to illuminate the construction site of the project, and it shall be connected to and energized from the Temporary Lighting System. All costs in connection with site security lighting shall be deemed included in the total Contract Price.
2. It is essential that the site security lighting system be completely installed and operating, at the earliest possible date. The Contractor shall direct its subcontractors to cooperate, coordinate and exert every effort to accomplish an early complete installation of the site security lighting system. After the system is installed and in operation, if a part of the system interferes with the work of any trade, the Contractor shall be completely responsible for the expense of removing,

relocating and replacing all equipment necessary to reinstate the system to proper operating conditions.

3. The system shall consist of flood lighting by pole mounted guarded sealed-beam units. Floodlight units shall be mounted 16 feet above grade. Floodlights shall be spaced around the perimeter of the site to produce an illumination level of no less than one (1) foot candle around the perimeter of the site, as well as in any potentially hazardous area or any other area within the site that might be deemed by the Resident Engineer to require security illumination. The system shall be installed in a manner acceptable to the Resident Engineer. The first lighting unit in each circuit shall be provided with a photoelectric cell for automatic control. The photoelectric cell shall be installed as per manufacturer's recommendations.
4. All necessary poles shall be furnished and installed by the Contractor.
5. The site security lighting shall be kept illuminated at all times during the hours of darkness. The Contractor shall, at its own expense, shall keep the system in operation, and shall furnish and install all material necessary to replace all damaged or burned out parts.
6. The Contractor shall be on telephone call alert for maintaining the system during the operating period stated above.
7. All materials and equipment furnished under this section shall remain the property of the Contractor and shall be removed and disposed of by the Contractor when authorized in writing by the Resident Engineer.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.5

3.5 TEMPORARY HEAT:

A. GENERAL:

1. Definition: The provision of Temporary Heat shall mean the provision of heat in order to permit construction to be performed in accordance with the Progress Schedule during all seasons of the year and to protect the work from the harmful effects of low temperature. In the event the building, or any portion thereof, is occupied during construction, the provision of Temporary Heat shall include the provision of heat to permit normal operations in such occupied areas.
   a. The provision of Temporary Heat shall be in accordance with the temperature requirements set forth in Sub-Section 3.5 C herein.
   b. The provision of Temporary Heat shall include the provision of: 1) all fuel necessary and required, 2) all equipment necessary and required, and 3) all operating labor necessary and required. Operating labor shall mean that minimum force required for the safe day to day operation of the system for the provision of Temporary Heat and shall include, without limitation, heating maintenance labor and/or Fire Watch as required by NYC Fire Department regulations. Operating labor may be required seven (7) days per week and during other than normal working hours, for the period of time required by seasonal weather conditions.
   c. In the event the building, or any portion thereof, is occupied and the Project involves the replacement, modification and/or shut down of the permanent heating system, or any key component thereof; and such system is a combined system which furnishes domestic hot water for the building occupants, the provision of Temporary Heat shall include the provision of domestic hot water at the same temperature as the system which is being replaced. Domestic hot water shall be provided in accordance with the phasing requirements set forth in the Contract Documents.
2. Responsibility: The Contractor's responsibility for the provision of Temporary Heat, including all expenses in connection therewith, shall be as set forth below:
   a. Projects Involving Enclosure of the Building:

1) Prior to Enclosure - Until the Commissioner determines that the building has been enclosed, as set forth in Sub-Section 3.5 B; the Contractor shall be responsible for the provision of Temporary Heat.
2) Post Enclosure - Once the Commissioner determines that the building, or any portion thereof, has been enclosed, as set forth in Sub-Section 3.5 B, the Contractor shall be responsible for the provision of Temporary Heat by one or more of the following means: 1) by an existing heating system (if any), 2) by a permanent heating system which is being installed as part of the Project, or 3) by a temporary heating system(s).
3) The Contractor shall, within two (2) weeks of the kick-off meeting, submit to DDC for review its proposed plan to provide Temporary Heat. Such plan is subject to approval by the Resident Engineer. The Contractor shall provide Temporary Heat in accordance with the approved plan until written acceptance by the Commissioner of the work of all Contractors, including punch list work, unless directed otherwise in writing by the Commissioner. The responsibility of the Contractor provided for herein is subject to the exception set forth in Sub-Section 3.5 A.2 (b) herein.

b. Projects not involving Enclosure of the Building:
1) If the Project involves the installation of a new permanent heating system if one did not exist previously, or the replacement, modification and/or shut down of the existing permanent heating system, or any key component thereof, the Contractor shall be responsible for the provision of Temporary Heat, except as otherwise provided in Sub-Section 3.5 H.3(b).2 herein.
2) If the Project does not involve the installation of a new permanent heating system if one did not exist previously, or the replacement, modification and/or shut down of the existing permanent heating system, or any key component thereof; there is no Contractor responsibility of the provision of Temporary Heat, unless otherwise specified in the Contract Documents. However, if the Commissioner, pursuant to Sub-Section 3.5 H.3 (b).1 herein, determines that the provision of Temporary Heat is necessary due to special and/or unforeseen circumstances, the Contractor shall be responsible for the provision of Temporary Heat and shall be paid for the same in accordance with Sub-Section 3.5 H.3 (b).1 herein.

B. ENCLOSURE OF STRUCTURES:
1. Notification: The Contractor shall notify all its subcontractors and the Resident Engineer at least 30 days prior to the anticipated date that the building(s) will be enclosed.
2. Commissioner Determination: The Commissioner shall determine whether the building, or any portion thereof, has been enclosed. As indicated in Sub-Section 3.5 A.2 above, once the building has been enclosed, the Contractor shall be responsible for the provision of Temporary Heat. The Commissioner's determination with respect to building enclosure shall be based upon all relevant facts and circumstances, including without limitation, 1) whether the building meets the criteria set forth in Paragraph 3 below, and 2) whether the openings in the building, such as doorways and windows, have been sufficiently covered so as to provide reasonable heat retention and protection from the elements.
3. Criteria for enclosure:
a. Roof Area:
1) A building shall be considered to be roofed when the area to be roofed is covered by a permanent structure and all openings through the permanent structure are covered and protected by temporary covers as described in Paragraph (c) below.
2) Intermediate floor structures of multi-floor buildings shall be considered to be roofed subject to the same requirements of the building roof.

3) The final roofing system need not be in place for the building or structure to be determined to be enclosed; provided, however, all openings through the permanent structure covering the roof must be covered and protected by temporary covers, as described in Paragraph (c) below.

b. Walls: For the walls to be determined to be enclosed permanent exterior wall elements or facing material must be in place and all openings must be covered and protected by temporary covers, as described in Paragraph (c) below.

c. Temporary Covers: In order to be acceptable, temporary covers must be securely fixed to prevent the entrance of rain, snow and direct wind. The minimum material requirements for temporary covers are as follows: 1) minimum 10 mil. Plastic 2) minimum 12 ounce waterproof canvas tarpaulins, or 3) a minimum three-eighths (3/8) inch thickness exterior grade plywood.

d. Temporary covers for openings shall be the responsibility of the Contractor and such work shall be deemed included in the Contract price.

C. TEMPERATURE REQUIREMENTS:

1. Unoccupied Buildings: The temperature requirement for the provision of Temporary Heat in unoccupied buildings shall be the GREATER of the following: 1) 50 degrees Fahrenheit, or 2) the temperature requirement for the particular type of work set forth in the Contract Documents.

2. Occupied Buildings: The temperature requirement for the provision of Temporary Heat in occupied buildings, or portions thereof, shall be the GREATER of the following: 68 degrees Fahrenheit or the temperature requirement for the particular type of work set forth in the Contract Documents.

D. DURATION:

1. The Contractor shall be required to provide Temporary Heat until the date on which it completes all required work at the site, including all punch list work, as certified in writing by the Resident Engineer, or earlier if so directed in writing by the Commissioner. The Contractor shall be responsible for the provision of Temporary Heat for the time specified herein, regardless of any delays in completion of the Project, including delays that result in the commencement of the provision of Temporary Heat during a season that is later than that which may have been originally anticipated. The Contractor shall include in its Total Contract Price all expenses in connection with the provision of Temporary Heat in accordance with the requirements specified herein.

2. The total Contract duration is set forth in consecutive calendar days in Schedule A of the Addendum. The Table set forth below indicates the number of full heating seasons that are deemed included in various contract durations, which are specified in consecutive calendar days (ccd)s. At a minimum, a full heating season shall extend from October 15th to April 15th.

Contract Duration	Full Heating Seasons Required
up to 360 ccds	1 full heating season
360 to 720 ccds	2 full heating seasons
more than 720 ccds	3 full heating seasons

E. METHOD OF TEMPORARY HEAT:

1. The method of temporary heat shall be in conformance with the New York City Fire Code and with all applicable laws, rules and regulations. Prior to implementation, such method shall be subject to the written approval of the Commissioner.

2. The method of temporary heat shall:

a. Not cause the deposition of dirt or smudges upon any finished work or cause any defacement or discoloration to the finished work.

b. Not be injurious or harmful to people or materials.

c. Portable fueled heating devises or equipment SHALL NOT BE ALLOWED for use as temporary heat other than construction-related curing or drying in conformance with the NYC Fire Code.

3. No open fires will be permitted.

F. TEMPORARY HEATING SYSTEM:

1. The temporary system for the provision of Temporary Heat provided by the Contractor following enclosure of the building shall be complete including, subject to provisions of paragraph E above, boilers pumps, radiators, space heaters, water and heating piping, insulation and controls. The temporary system for the provision of Temporary Heat shall be capable of maintaining the minimum temperature requirements set forth in Paragraph C above.

G. COORDINATION:

1. The Contractor, in the provision of Temporary Heat, shall coordinate its operations in order to insure sufficient and timely performance of all required work, including work performed by trade subcontractors. The Contractor shall supply and pay for all water required and used in the building for the operation of the heating system(s) for the purpose of Temporary Heat. The Contractor shall include all expenses in connection with the supply of water for Temporary Heat in its Total Contract Price. During the period in which Temporary Heat in an enclosed building is being furnished and maintained, the Contractor shall provide proper ventilating and drying, open and close the windows and other openings when necessary for the proper execution of the work and also when directed by DDC. The Contractor shall maintain all permanent or temporary enclosures at its own expense.

H. USE OF PERMANENT HEATING SYSTEMS:

1. Use of Permanent Heating System for Temporary Heat after Building Enclosure
   a. The Contractor shall provide all labor and materials to promptly furnish and set all required equipment and convectors and/or radiators, piping, valves, fitting, etc., in ample time for their use for the provision of Temporary Heat after enclosure of the building.
   b. New portions of the permanent heating system that are used for furnishing Temporary Heat shall be left in near perfect condition when delivered to the City for operation. Any repairs required, other than for ordinary wear and tear on the equipment, shall be made by the Contractor at his/her expense. The starting date for the warranty or guarantee period for such equipment shall be the date of Substantial Completion acceptance.
   c. In the event that the Contractor does not advance the installation of the permanent heating system in sufficient time to permit its use for Temporary Heat as determined by DDC, the Contractor shall furnish and install a separate system for the provision of Temporary Heat as required to maintain the minimum temperature requirements set forth in Paragraph C above.

2. All equipment for the system for the provision of Temporary Heat shall be placed so as to comply with the requirements specified hereinbefore, and shall be connected, disconnected and suitably supported and located so as to permit construction work, including finish work such as wall plastering and painting, to proceed. The installation of the system for the provision of Temporary Heat by the Contractor, including the placing of ancillary system equipment, shall be coordinated with the operations of all trade subcontractors so as to insure sufficient and timely performance of the work. Once the permanent heating system is operating properly, the Contractor shall remove all portions of the system for Temporary Heat not part of the permanent heating system.

3. Temporary Heat Allowance for Special Conditions or and/or Unforeseen Circumstances.
   a. The City may establish an allowance in the Contract for payment of costs and expenses in connection with the provision of Temporary Heat as set forth herein. If established, the City will include an amount for such allowance on the Bid Form, and the Contractor shall

include such allowance amount in its Total Contract Price. The Contractor shall only be entitled to payment from this allowance under the conditions and in accordance with the requirements set forth below. In the event this allowance or any portion thereof remains unexpended at the conclusion of the Contract, such allowance shall remain the sole property of the City. Should the amount of the allowance be insufficient to provide payment for the expenses specified below, the City will increase the amount of the allowance.

b. The allowance set forth herein may be utilized only under the conditions set forth below.
   1. In the event the Project does not involve the installation of a new permanent heating system if one did not exist previously, or the replacement, modification and/or shut down of the existing permanent heating system, or any key component thereof, and the Commissioner determines that the provision of Temporary Heat is necessary due to special and/or unforeseen circumstances, the Contractor shall be responsible for the provision of Temporary Heat, as directed by the Commissioner. The City shall pay such Contractor for all costs for labor, material, and equipment necessary and required for the same. Payment shall be made in accordance with Article 26 of the Contract, except that the cost of fuel shall be as set forth in Paragraph (c) below.
   2. In the event the Commissioner determines that there is a need for maintenance of the permanent heating system by the Contractor after written acceptance by the Commissioner of the work, and that the need for such maintenance is not the fault of the Contractor, the Contractor shall provide the required maintenance of the permanent heating system for the period of time directed by the Commissioner. The City shall pay the Contractor for the cost of direct labor and fuel necessary and required in connection with such maintenance, excluding the cost of any foremen or other supervision. Payment shall be made in accordance with Article 26 of the Contract, except that the cost of fuel shall be as set forth in Paragraph (c) below.

c. Payment for Fuel Costs - Payment from the allowance set forth herein for the cost of fuel necessary and required to operate the system for the provision of Temporary Heat or to maintain the permanent heating system under the conditions set forth in Paragraph b above shall be limited to the direct cost of such fuel. The Contractor shall not be entitled to any overhead and/or profit for such fuel costs. In order to receive payment for such fuel costs, the Contractor must present original invoices for the same. DDC reserves the right to furnish the required fuel.

I. RELATED ELECTRICAL WORK:

1. The Contractor shall be responsible for providing the items set forth below and shall include all expenses in connection with such items in its Total Contract Price. The Contractor shall provide such items promptly when required and shall in all respects coordinate its work with the work performed by trade subcontractors in order to facilitate the provision of Temporary Heat.
   a. The Contractor shall provide all labor, materials, equipment and power necessary and required to furnish and maintain any temporary or permanent electrical connections to all equipment specified to be connected as part of the work of his Contract.
   b. The Contractor shall supply and pay for all power necessary and required for the operation of the system for the provision of Temporary Heat and/or the permanent heating system used for Temporary Heat. Such power shall be provided by the Contractor for the duration the Contractor is required to provide Temporary Heat, as set forth in Sub-section 3.5 D herein.
2. In providing the items set forth in Paragraph 1 above, the Contractor is advised that labor may be required seven (7) days a week and/or during other than normal working hours for the period of time required by seasonal weather conditions.

J. RELATED PLUMBING WORK:

1. The Contractor shall be responsible for providing all labor, materials and equipment necessary and required to furnish and maintain all temporary or permanent connections to all equipment or plumbing outlets specified to be provided as part of the work of this Contract. The Contractor shall include all expenses in connection with such items of work in its Total Contract Price. The Contractor shall provide such items of work promptly when required and shall in all respects coordinate its work with the work performed by trade subcontractors in order to facilitate the provision of Temporary Heat.
2. In the event portions of the permanent plumbing equipment furnished by the Contractor as part of the work of this Contract are used for the provision of Temporary Heat either during construction or prior to acceptance by the City of the complete plumbing system, the Contractor shall be responsible to provide such plumbing equipment to the City in near perfect condition and shall make any repairs required, other than for ordinary wear and tear on the equipment, at his expense. The starting date for warranty and/or guarantee period for such plumbing equipment shall be the date of Substantial Completion acceptance by the City.
3. For Projects requiring the installation of new and/or modified gas service, as well as associated meter installations, the Contractor shall promptly perform all required filings and coordination with the Utility Companies in order to expedite the installation, testing, and approval of the gas service and associated meter(s).

3.6 STORM WATER CONTROL, DEWATERING FACILITIES AND DRAINS:

A. PUMPING:

1. Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rainfall.
2. Contractor shall furnish and install all necessary automatically operated pumps of adequate capacity with all required piping to run-off agencies, so as to maintain the excavation, cellar floor, pits and exterior depressions and excavations free from accumulated water during the entire period of construction and up to the date of final acceptance of work of the Contract.
3. All pumps shall be maintained at all times in proper working order.
4. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
5. Remove snow and ice as required to minimize accumulations.

3.7 TEMPORARY FIELD OFFICE FOR CONTRACTOR:

A. The Contractor shall establish a temporary field office for its own use at the site during the period of construction, at which readily accessible copies of all Contract Documents shall be kept.

B. The field office shall be located where it will not interfere with the progress of any part of the work or with visibility of traffic control devices.

C. CONTRACTOR'S REPRESENTATIVE: In charge of the office there shall be a responsible and competent representative of the Contractor, duly authorized to receive orders and directions and to put them into effect.

D. Arrangements shall be made by the Contractor whereby its representative may be readily accessible by telephone.

E. All temporary structures shall be of substantial construction and neat appearance, and shall be painted a uniform gray unless otherwise directed by the Commissioner.

F. CONTRACTOR'S SIGN - The Contractor shall post and keep posted, on the outside of its field office, office or exterior fence or wall at site of work, a legible sign giving full name of the company, address of the company and telephone number(s) of responsible representative(s) of the firm who can be reached in event of an emergency at any time.

G. ADVERTISING PRIVILEGES - The City reserves the right to all advertising privileges. The Contractor shall not cause any signs of any kind to be displayed at the site unless specifically required herein or authorized by the Commissioner.

3.8 DDC FIELD OFFICE:

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.8 A

A. OFFICE SPACE IN EXISTING BUILDING:

1. The Resident Engineer will arrange for office space for sole use in the building where work is in progress. The Contractor shall provide and install a lockset for the door to secure the equipment in the room. The Contractor shall provide two (2) keys to the Resident Engineer. After completion of the project the Contractor shall replace the original lockset on the door and ensure its proper operation.
2. In addition to equipment specified in Sub-Section 3.8 D, the Contractor shall provide, for exclusive use of the DDC Field Office, the following:
   a. Two (2) single pedestal desks, 42" x 32"; two (2) swivel chairs with arms and three (3) side chairs without arms to match desk. Two metal (2) lockers, single units, 15" x 18" x 78" overall including 6" legs. Lockers to have flat key locks with two (2) keys each, General Steel products or approved equal. Two (2) full ball bearing suspension four (4) drawer vertical legal filing cabinets with locks, approximately 52"H x 28 ½"D x 18"W.
   b. One (1) 9000 B.T.U air conditioner or as directed by Commissioner. Wiring for the air conditioner shall be minimum No. 12 AWG fed from individual circuits in the fuse box.
   c. One (1) folding conference table, 96" x 30" and ten (10) folding chairs.
   d. Two (2) metal wastebaskets.
   e. One (1) fire extinguisher, one (1) quart vaporizing liquid type, brass, wall mounted by Pyrene No. C21 or approved equal.
   f. One (1) Crystal Springs water cooler with bottled water, Model No. LP14058 or approved equal to be furnished for the duration of the project as required.
3. The Contractor shall provide one (1) telephone, where directed and shall pay all costs for telephone service for calls within the New York City limits for the duration of the project.
4. All furniture and equipment, except computer equipment specified in Sub-Section 3.8 D.3, shall remain the property of the Contractor.
5. Computer Workstation quantities shall be provided as specified in Sub-Section 3.8 B 3-a for DDC Managed Projects, or Sub-Section 3.8 B 3-b for CM Managed Projects.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.8 B

B. DDC FIELD OFFICE TRAILER:

1. GENERAL: The Contractor shall, for the time frame specified herein, provide and maintain at its own cost and expense a DDC Construction Field Office and all related items as specified herein [hereinafter collectively referred to as the "DDC Field Office"] for the exclusive use of the Resident Engineer. The DDC Field Office shall be located at the Project site and shall be solely dedicated to the Project. Provision of the DDC Field Office shall commence within THIRTY (30) days from Notice to proceed and shall continue through forty-five (45) days after Substantial Completion of the required construction at the Project site. The Contractor shall remove the DDC Field Office forty-five (45) days after Substantial Completion of the required construction, or as otherwise directed in writing by the Commissioner.
2. TRAILER: The Contractor shall provide at its own cost and expense a mobile office trailer for use as the DDC Field Office. The Contractor shall install and connect all utility services to the

trailer within thirty (30) days from Notice to Proceed. The trailer shall have equipment in compliance with the minimum requirements hereinafter specified. Any permits and fees required for the installation and use of said trailer shall be borne by the Contractor. The trailer including furniture and equipment therein, except computer equipment specified in Sub-Section 3.8D.3 herein, shall remain the property of the Contractor.

3. Trailer shall be an office type trailer of the size specified herein, with exterior stairs at entrance. Trailer construction shall be minimum 2 x 4 wall construction fully insulated with paneled interior walls, pre-finished gypsum board ceilings and vinyl tile floors.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.8.B.3a or SUB-SECTION 3.8.B.3b.

a. DDC Managed Project Trailer: DDC Field Office Trailer Size, Layout and Computer Workstation:
   1) Overall length: 32 Feet
      Overall width: 10 Feet
   2) Interior Layout:
      Provide one (1) general office/conference room area and one (1) private office at one end of the trailer. Provide equipment and amenities as specified in Sub-Section 3.8.B herein.
   3) Computer Workstation: Provide one (1) complete computer workstation, as specified in Sub-Section 3.8.D herein, in the private office area as directed by the Resident Engineer.

b. CM Managed Project Trailer: DDC Field Office Trailer Size, Layout and Computer Workstation:
   1) Overall length: 50 Feet
      Overall width: 10 Feet
   2) Interior Layout:
      Provide one (1) large general office/conference room in the center of the trailer and two (2) private offices, one (1) each at either end of the trailer. Provide equipment and amenities as specified in Sub-Section 3.8.B herein.
   3) Computer Workstation:
      Provide three (3) complete computer workstations as specified in Sub-Section 3.8.D herein. Provide one (1) each complete computer workstation in each private office and one (1) complete computer workstation at the secretarial position as directed by the Resident Engineer.

4. The exterior of the trailer shall be lettered with black block lettering of the following heights with white borders:

CITY OF NEW YORK	2-1/2"
DEPARTMENT OF DESIGN AND CONSTRUCTION	3-3/4"
DIVISION OF PUBLIC BUILDINGS	3-1/2"
DDC FEILD OFFICE	2-1/2"

NOTE: In lieu of painting letters on trailer the Contractor may substitute a sign constructed of a good quality weatherproof material with the same type and size of lettering above.

5. All windows and doors shall have aluminum insect screens. Provide wire mesh protective guards at all windows.

6. The interior shall be divided by partitions into general and private office areas as specified herein. Provide a washroom located adjacent to the private office and a built-in wardrobe closet opposite the washroom. Provide a built-in desk in the private office(s) with fixed overhead shelf and clearance below for two (2) file cabinets.

7. Provide a built-in drafting or reference table, located in the general office/conference room, at least 60 inches long by 36 inches wide with cabinet below and wall type plan rack at least 42 inches wide.
8. The washroom shall be equipped with a flush toilet, wash basin with two (2) faucets, medicine cabinet, complete with supplies and a toilet roll tissue holder. Plumbing and fixtures shall be approved house type, with each appliance trapped and vented and a single discharge connection. Five (5) gallon capacity automatic electric heater for domestic hot water shall be furnished.
9. HVAC: The trailer shall be equipped with central heating and cooling adequate to maintain a temperature of 72 degrees during the heating season and 75 degrees during the cooling season when the outside temperature is 5 degrees F. winter and 89 degrees F. summer.
10. Lighting shall be provided via ceiling mounted fluorescent lighting fixtures to a minimum level of 50 foot candles in the open and private office(s) along with sufficient lighting in the washroom. Broken and burned out lamps shall be replaced by the Contractor. A minimum of four (4) duplex convenience outlets shall be provided in the open office and two (2) each in the private office(s). These outlets shall be in addition to special outlet requirements for computer stations, copiers, HVAC unit, etc.
11. Electrical service switch and panel shall be adequately sized for the entire trailer load. Provide dedicated circuits for HVAC units, hot water heater, copiers and other equipment as required. All wiring and installation shall conform to the New York City Electrical Code.
12. The following movable equipment shall be furnished:
    a. Two (2) single pedestal desks, 42" x 32"; two (2) swivel chairs with arms and three (3) side chairs without arms to match desk. Two (2) full ball bearing suspension four (4) drawer vertical legal filing cabinets with locks and two (2) full ball bearing two (2) drawer vertical legal filing cabinets in each private office located below built-in desk.
    b. One (1) folding conference table, 96" x 30" and ten (10) folding chairs.
    c. Three (3) metal wastebaskets.
    d. One (1) fire extinguisher one (1) quart vaporizing liquid type, brass, wall mounted by Pyrene No. C21 or approved equal.
    e. One (1) Crystal Springs water cooler with bottled water, Model No. LP14058 or approved equal to be furnished for the duration of the Contract as required.
13. TRAILER TEMPORARY SERVICE: Plumbing and electrical work required for the trailer will be furnished and maintained as below.

    a. PLUMBING WORK: The Contractor shall provide temporary water and drainage service connections to the DDC Field Office trailer for a complete installation. Provide all necessary soil, waste, vent and drainage piping.

       Contractor to frost-proof all water pipes to prevent freezing.
       1) REPAIRS, MAINTENANCE: The Contractor shall provide repairs for the duration of the project until the trailer is removed from the site.
       2) DISPOSITION OF PLUMBING WORK: At the expiration of the time limit set forth in Sub-Section 3.8 B 1 herein, the temporary water and drainage connections and piping to the DDC Field Office trailer shall be removed by the Contractor and shall be plugged at the mains. All piping shall become the property of the Contractor for Plumbing Work and shall be removed from the site, all as directed. All repair work due to these removals shall be the responsibility of the Contractor.

    b. ELECTRICAL WORK:
       1) The Contractor shall furnish, install and maintain a temporary electric feeder to the DDC Field Office trailer immediately after it is placed at the job site.
       2) The temporary electrical feeder and service switch/fuse shall be adequately sized based on the trailer load and installed per the New York City Electrical Code and complying with utility requirements.

3) Make all arrangements and pay all costs to provide electric service.
4) The Contractor shall pay all costs for current consumed and for maintenance of the system in operating condition, including the furnishing of the necessary bulb replacements lamps, etc., for the duration of the project and for a period of forty-five (45) days after the date of Substantial Completion.
5) Disposition of Electric Work: At the expiration of the time limit set forth, the temporary feeder, safety switch, etc., shall be removed and disposed of as directed.
6) All repair work due to these removals shall be the responsibility of the Contractor.

c. MAINTENANCE
1) The Contractor shall provide and pay all costs for regular weekly janitor service and furnish toilet paper, sanitary seat covers, cloth towels and soap and maintain the DDC Field Office in first-class condition, including all repairs, until the trailer is removed from the site.
2) Supplies: The Contractor shall be responsible for providing (a) all office supplies, including without limitation, pens, pencils, stationery, filtered drinking water and sanitary supplies, and (b) all supplies in connection with required computers and printers, including without limitation, an adequate supply of blank CD's/DVD's, storage boxes for blank CDs/DVDs, and paper and toner cartridges for the printer.
3) Risk of Loss: The entire risk of loss with respect to the DDC Field Office and equipment shall remain solely and completely with the Contractor. The Contractor shall be responsible for the cost of any insurance coverage determined by the Contractor to be necessary for the Field Office.
4) At forty-five (45) days after the date of Substantial Completion, or sooner as directed by the Commissioner, the Contractors shall have all services disconnected and capped to the satisfaction of the Commissioner. All repair work due to these removals shall be the responsibility of the Contractor.

d. TELEPHONE SERVICE: The Contractor shall provide and pay all costs for the following telephone services for the DDC Field Office trailer:
1) Separate telephone lines for one (1) desk phone in each private office.
2) One (1) wall phone (with six (6) foot extension cord) at plan table.
3) Separate telephone lines for the fax machine and internet access in each private office. Telephone service shall include voice mail.
4) A remote bell located on outside of trailer
5) The telephone service shall continue until the trailer is removed from the site.

e. PERMITS: The Contractor shall make the necessary arrangements and obtain all permits and pay all fees required for this work.

C. RENTED SPACE: The Contractor has the option of providing, at its cost and expense, rented office or store space in lieu of trailer. Said space shall be in the immediate area of the Project and have adequate plumbing, heating and electrical facilities. Space chosen by the Contractor for the DDC Field Office must be approved by the Commissioner before the area is rented. All insurance, maintenance and equipment, including computer workstations specified in Sub-Section 3.8 D in quantities required as specified in Sub-Section 3.8 B 3 for the DDC Field Office trailer, shall also apply to rented spaces.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.8 D

D. ADDITIONAL EQUIPMENT FOR THE DDC FIELD OFFICE:
1. The Contractor shall provide a high volume copy machine (50 copies per minute) for paper sizes 8½ x 11, 8½ x 14 & 11 x 17. Copier shall remain at job site until the DDC Field office trailer is removed from the site.

2. The Contractor shall furnish a fax machine and a telephone answering machine at commencement of the project for the exclusive use of the DDC Field Office. All materials shall be new, sealed in manufacturer's original packaging and shall have manufacturers' warrantees. All items shall remain the property of the City of New York at the completion of the project.

3. COMPUTER WORKSTATION: The Contractor shall provide one complete computer workstation, in quantities specified in Sub-Section 3.8.B.3, as specified herein:

   a. Hardware/Software Specification:

      1) Computer Equipment - Computers shall be provided for all contracts that have a Total Consecutive Calendar Days for construction duration as set forth in Schedule "A" of 180 CCD's or greater. Contracts of lesser duration shall not require computers.

      2) Computers furnished by the Contractor for use by City Personnel, for the duration of the contract, shall be in accordance with Specific Requirements, contained herein, shall remain the property of the City of New York at the completion of the project and shall meet the following minimum requirements:

      3) Personal Computer(s) – Each Workstation Configuration.

a) Make and Model:	Dell; HP; Gateway; Acer; or, an approved equivalent. (Note: an approved equivalent requires written approval of the Assistant Commissioner of ITS.)
b) Processor:	i5-2400 (6MB Cache, 3.1GHz) or faster computer - Single Processor.
c) System RAM:	Minimum of 4GB (Gigabytes) Dual Channel DDR3 SDRAM at 1333MHz – 2 DIMMSs
d) Hard Disk Drive(s):	500 GB (Gigabytes) Serial ATA (7200RPM) w/DataBurst Cache, or larger.
e) CD-RW:	Internal CD-RW, 48x Speed or faster.
f) 16xDVD+/-RW	DVD Burner (with double layer write capability) 16x Speed or faster
g) I/O Ports:	Must have at least one (1) Serial Port, one (1) Parallel Port, and three (3) USB Ports.
h) Video Display Card:	HD Graphics (VGA, HDMI) with a minimum of 64 MB of RAM.
i) Monitor:	22" W, 23.0 Inch VIS, Widescreen, VGA/DVI LCD Monitor.
j) Available Exp. Slots:	System as configured above shall have at least two (2) full size PCI Slots available.
k) Network Interface:	Integrated 10/100/1000 Ethernet card.
l) Other Peripherals:	Optical scroll Mouse, 101 Key Keyboard, Mouse Pad and all necessary cables.
m) Software Requirement:	Microsoft Windows 7 Professional SP1, 32 bit; Microsoft Office Professional 2010 or 2013; Microsoft Project 2010; Adobe Acrobat reader; Anti-Virus software package with 2 year updates subscription; and, either Auto Cad LT or Microsoft

Visio Standard Edition, as directed by the Resident Engineer.

4) DDC Field Office Specs: DDC Field Offices requiring computers shall be provided with the following:
   a) One (1) broad-band internet service account. Wideband Internet connectivity at a minimum throughput of 15 Mbps download and 5 Mbps upload is required at each field office location with 1-5 staffers. For larger field offices see table below for minimum required upload speeds. Telephone service should be bundled together with Internet connectivity. Because of throughput requirements Verizon FIOS is the preferred connectivity provider where available.

Office Personnel #	**Upload Speeds (*Minimum*)**
1 – 5	5 Mbps
6 – 10	10 Mbps
11 – 15	15 Mbps
16 – 20 …	20 Mbps

   This account will be active for the life of the project. The e-mail name for the account shall be the DDC Field Office/project Id (e.g. FLD K HWK666 McGuinness@earthlink.com).
   b) One (1) 600 DPI HP Laser Jet Printer (twelve (12) pages per minute or faster) with one (1) Extra Paper (Legal Size)
   c) All necessary cabling for equipment specified herein.
   d) Storage Boxes for Blank CD's
   e) Printer Table
   f) UPS/Surge Suppressor combo

5) All computers required for use in the Engineer's Field Office shall be delivered, installed, and setup in the Field Office by the Contractor.

6) All Computer Hardware shall come with a three (3) year warranty for on-site repair or replacement. Additionally, and notwithstanding any terms of the warranty to the contrary, the Contractor is responsible for rectifying all computer problems or equipment failures within one (1) business day.

7) An adequate supply of blank CDs/DVDs, and paper and toner cartridges for the printer shall be provided by the Contractor, and shall be replenished by the Contractor as required by the Resident Engineer.

8) It is the Contractor's responsibility to ensure that electrical service and phone connections are also available at all times; that is, the Field Office Computer(s) is to be powered and turned on twenty-four (24) hours each day.

9) Broadband connectivity is preferred at each field office location. Please take into consideration that an extra phone line dedicated to the modem must be ordered as part of the contract unless Internet broadband connectivity, via Cable or DSL, is available at the planned field office location. Any questions regarding this policy should be directed to the Assistant Commissioner of Information Technology Services at 718-391-1761.

10) Ownership: The equipment specified above shall, unless otherwise directed by the Commissioner, be the sole property of the City of New York upon delivery to the DDC Field Office. The Contractor shall prepare and maintain an accurate inventory of all equipment which it purchases for the DDC Field Office. Such inventory shall be provided to the City of New York. Upon completion of the

required services, as directed by the Commissioner, the Contractor shall turn such equipment over to the City of New York.

E. HEAD PROTECTION (HARD HATS):
1. The Contractor shall provide a minimum of 10 standard protective helmets for the exclusive use of Department of Design and Construction personnel and their visitors. Helmets shall be turned over to the Resident Engineer and kept in the DDC Field Office.
2. Upon completion of the project, the helmets shall become the property of the Contractor.

3.9 MATERIAL SHEDS:

A. Material sheds used by the Contractor for the storage of its materials shall be kept at locations which will not interfere at any time with the progress of any part of the work or with visibility of traffic control devices.

B. Store combustible materials apart from the facility.

3.10 TEMPORARY ENCLOSURES:

A. Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

B. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

3.11 TEMPORARY PARTITIONS:

A. Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate occupied tenant areas from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
2. Construct dustproof partitions with 2 layers of 3-mil (0.07-mm) polyethylene sheet on each side. Cover floor with 2 layers of 3-mil (0.07-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
   a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
3. Insulate partitions to provide noise protection to occupied areas.
4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
5. Protect air-handling equipment.
6. Weather strip openings.
7. Provide walk-off mats at each entrance through temporary partition.

3.12 TEMPORARY FIRE PROTECTION:

A. Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

B. Prohibit smoking in all areas.

C. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

D. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

E. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.13

3.13 WORK FENCE ENCLOSURE:

A. The Contractor shall furnish, erect and maintain a wood construction or chain-link fence to the extent shown on the drawings or required by the work enclosing the entire project on all sides. All materials used shall be new. Any permit required for the installation and use of said fence and costs shall be borne by the Contractor.

B. WOOD FENCE shall be 7'-0" high with framing construction of yellow pine, using 4" x 4" approved preservative-treated posts on not more than 6'-0" centers, with three (3) rails of at least 2" x 4" size to which shall be secured minimum 1/2 inch thick exterior grade plywood. Posts shall be firmly fixed in the ground at least 30" and thoroughly braced. Top edge of fence shall be trimmed with a rabbeted edge mould. Provide on the street traffic sides of fence, observation openings as directed.

1. GATES - Provide an adequate number of double gates, complete with hardware, located as approved by the Resident Engineer. Double gates shall have a total clear opening of 14'-0" with two (2) 7'-0" hinged swinging sections. Hanging posts shall be 6" x 6" and shall extend high enough to receive and be provided with tension or sag rods for the swinging sections.
2. PAINTING - The fence and gates shall be entirely painted on the street and public sides with one (1) coat of exterior primer and one (1) top coat of exterior grade acrylic-latex emulsion paint. Black stenciled signs reading "POST NO BILLS" shall be painted on fence with three (3) inch high letters on 25 foot spacing for the entire length of fence on street traffic sides. Signs shall be stenciled five (5) feet above the sidewalk.

C. CHAIN-LINK FENCING shall be minimum 2-inch thick, galvanized steel, chain-link fabric fencing; 8 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Fence shall be accurately aligned and plumb, adequately braced and complete with gates, locks and hardware as required. Under no condition shall fencing be attached or anchored to existing construction or trees.

D. 1. It shall be the obligation of the Contractor to remove all posters, advertising signs, and markings, etc., immediately.
2. Should the fencing be required to be relocated during the course of the Contract, it shall be done by the Contractor at no additional cost to the City.
3. Where sidewalks are used for "drive over" purposes for Contractor vehicles, a suitable wood mat or pad shall be provided for protection of sidewalks and curbs.
4. Where required, make provision for fire hydrants, lampposts, etc.
5. REMOVAL - When directed by the Resident Engineer, the fence shall be removed.

3.14 RODENT AND INSECT CONTROL:

A. DESCRIPTION: The Contractor shall provide all labor, materials, plant and equipment, and incidentals required to survey and monitor rodent activity and to control any infestation or outbreak of rodents, rats, mice, water beetles, roaches and fleas within the project area. Special attention should be paid to the following conditions or areas:

1 Wet areas within the project area, including all temporary structures.
2 All exterior and interior temporary toilet structures within the project area.
3 All Field Offices and shanties within the project area of all subcontractors and DDC.
4 Wherever there is evidence of food waste and/or discarded food or drink containers, in quantity, that would cause breeding of rodents or the insects herein specified.
5 Any other portion of the premises requiring such special attention.

B. MATERIALS:

1 All materials shall be approved by the New York State Department of Environmental Conservation and comply with the New York City Health Code, OSHA and the laws, ordinances and regulations of State and Federal agencies pertaining to such chemical and/or materials.

C. PERSONNEL:

1 All pest control personnel must be supervised by an exterminator licensed in categories 7A and 8.

D. METHODS:

1. Application and dosage of all materials shall be done in strict compliance with the manufacturer's recommendations.
2. Any unsanitary conditions, such as uncollected garbage or debris, resulting from all Contractor's activities, which will provide food and shelter to the resident rodent population shall be corrected by the Contractor immediately after notification of such condition by the Resident Engineer.

E. RODENT CONTROL WORK:

1 In wetlands, woodlands and areas adjacent to a stream, special precautions must be taken to protect water quality and to ensure the safety of other wildlife. To prevent poisoned bait from entering streams, no poisoned bait shall be used in areas within seventy-five (75) feet of all stream banks. Live traps must be used in these seventy-five (75) foot buffer zone areas and within wetland and woodland areas.
2 In areas outside the seventy-five (75) foot zone of protection adjacent to streams, and in areas outside wetlands and woodlands, tamper proof bait stations with poisoned bait shall be placed during the period of construction and any consumed or decomposed bait shall be replenished as directed.
3 At least one month prior to initiation of the construction work, and periodically thereafter, live traps and/or rodenticide bait in tamper proof bait stations, as directed above, shall be placed at locations that are inaccessible to pets, human beings, children and other non-target species, particularly wildlife (for example-birds) in the project area.
4 The Contractor shall be responsible for collecting and disposing of all trapped and poisoned rodents found in live traps and tamper proof bait stations. The Contractor shall also be responsible for posting and maintaining signs announcing the baiting of each particular location.
The Contractor shall be responsible for the immediate collection and disposal of any visible rodent remains found on streets or sidewalks within the project area.
5 It is anticipated that public complaints will be addressed to the Commissioner. The Contractor, where directed by the Commissioner, shall take appropriate actions, like baiting, trapping, proofing, etc., to remedy the source of complaint within the next six (6) hours of normal working time which is defined herein for the purposes of this section as 7 A.M. to 6 P.M. on Mondays through Saturdays.
6 Emergency service during the regular workday hours (Monday through Friday) shall be rendered within 24 hours, if requested by the Commissioner, at no additional cost to the City.

F. EDUCATION & NOTICES:

1 The Contractor shall post notices on all Construction Bulletin Boards advising workers, employees, and residents to call the Engineer's Field Office to report any infestation or outbreak of rodents, rats, mice, water beetles, roaches and fleas within the project area. The Contractor shall provide and distribute literature pertaining to IPM techniques of rodent control to affected businesses and superintendents of nearby residential buildings to ensure their participation in maintaining their establishments free of unsanitary conditions, harborage removal and rodent proofing.

2 Prior to application of any chemicals, the Contractor shall furnish to the Commissioner copies or sample labels for each pesticide, antidote information, and Material Data Safety Sheets (MSDS) for each chemical used.

G. RECORDS

1. The Contractor shall keep a record of all rodent and waterbug infestation surveys conducted by him/her and make available, upon request, to the Commissioner. The findings of each survey shall include, but not be limited to, recommended Integrated Pest Management (IPM) techniques, like baiting, trapping, proofing, etc., proposed for rodent and waterbug pest control.
2. The Contractor shall maintain records of all locations baited along with the type and quantity of rodenticide and insecticide bait used.

3.15 PLANT PEST CONTROL REQUIREMENTS and TREE PROTECTION REQUIREMENTS:

A. Plant Pest Control Requirements: The Contractor and its subcontractors, including the Certified Arborist described below, shall comply with all Federal and New York State laws and regulations concerning Asian Longhorned Beetle (ALB) management, including protocols for ALB eradication and containment promulgated by the New York State Department of Agriculture and Markets (NYSDAM). The Contractor is referred to: (1) Part 139 of Title 1 NYCRR, Agriculture and Markets Law, Sections 18, 164 and 167, as amended, and (2) State Administrative Procedure Act, Section 202, as amended.

1. All tree work performed within the quarantine areas must be performed by New York State Department of Agriculture and Markets (NYSDAM) certified entities. Transportation of all host material, living, dead, cut or fallen, inclusive of nursery stock, logs, green lumber, stumps, roots, branches and debris of a half inch or more in diameter from the quarantine areas is prohibited unless the Contractor or its sub-contractor performing tree work has entered into a compliance agreement with NYSDAM. The terms of said compliance agreement shall be strictly complied with. Any host material so removed shall be delivered to a facility approved by NYSDAM. For the purpose of this contract host material shall be ALL species of trees.

2. Any host material that is infested with the Asian Longhorned Beetle must be immediately reported to NYSDAM for inspection and subsequent removal by either State or City contracts, at no cost to the Contractor.

3. Prior to commencement of tree work, the Contractor shall submit to the Commissioner a copy of a valid Asian Longhorned Beetle compliance agreement entered into with NYSDAM and the Contractor or its sub-contractor performing tree work. If any host material is transported from the quarantine area the Contractor shall immediately provide the Commissioner with a copy of the New York State 'Statement of Origin and Disposition' and a copy of the receipt issued by the NYSDAM approved facility to which the host materials are transported.

4. Quarantine areas, for the purpose of this contract shall be defined as all five boroughs of the City of New York. In addition, prior to the start of any tree work, the Contractor shall contact the

NYC Department of Parks & Recreation's Director of Landscape Management at (718) 699-6724, to determine the limits of any additional quarantine areas that may be in effect at the time when tree work is to be performed. The quarantine area may be expanded by Federal and State authorities at any time and the Contractor is required to abide by any revisions to the quarantine legislation while working on this contract. For further information please contact: NYSDAM (631) 288-1751.

B. Tree Protection Requirements: The Contractor shall retain a Certified Arborist, as defined by New York City Department of Parks and Recreation (NYCDPR) regulations, to provide the services described below.

1. Surveys and Reports: The Certified Arborist shall, at the times indicated below, conduct a survey and prepare a plant material assessment report which includes: (1) identification, by species and pertinent measurements, of all plant material located on the project site, or in proximity to the project site, as described below, including all trees, significant shrubs and/or planting masses; (2) identification and plan for the containment of plant pests and pathogens, including the ALB, as described in paragraph A above; (3) evaluation of the general health and condition of any infected plant material.

2. Frequency of Reports: The Certified Arborist shall conduct a survey and provide a plant material assessment report at two (2) points in time: (1) prior to the commencement of construction work; and (2) at the time of substantial completion. In addition, for projects exceeding 24 months in duration, the Certified Arborist shall conduct a survey and prepare a report at the midpoint of construction. Copies of each plant material assessment report shall be submitted to the Resident Engineer within two (2) weeks of the survey.

3. Proximity to Project Site: Off-site trees, significant shrubs and/or planting masses shall be considered to be located in proximity to the project site under the circumstances described below.

   a. The tree trunk, significant shrub, or primary cluster of stems in a planting mass is within 50 (fifty) feet of the project's Contract Limit Lines (CLLs) or Property Lines (PLs).
   b. Any part of the tree or shrub stands within 50 (fifty) feet of: (a) a path for site access for vehicles and/or construction equipment; or (b) scaffolding to be erected for construction activity, including façade remediation projects.
   c. The Certified Arborist determines that the critical root zone (CRZ) of an off-site tree, significant shrub, or primary cluster of stems in a planting mass extends into the project site, whether or not that plant material is located within the 50-foot inclusionary perimeter as outlined above.

4. Tree Protection Plan: The Certified Arborist shall prepare, and the Contractor shall implement, a Tree Protection Plan, for all trees that may be affected by any construction work, excavation or demolition activities, including without limitation, (1) on-site trees, (2) street trees, as defined below, (3) trees under NYCDPR jurisdiction as determined by the Department of Transportation, and (4) all trees that are located in proximity to the project site, as defined above. The Tree Protection Plan shall comply with the NYC DPR rules, regulations and specifications. The Contractor is referred to Chapter 5 of Title 56 of the Official Compilation of the Rules of the City of New York. Copies of the Tree Protection Plan shall be submitted to the Resident Engineer prior to the commencement of construction. Implementation of the Tree Protection Plan for street trees and trees under NYCDPR jurisdiction shall be in addition to any tree protection requirements specified or required for the project site. For the purpose of this article, a "street tree" means the following: (1) a tree that stands in a sidewalk, whether paved or unpaved, between the curb lines or lateral lines of a roadway and the adjacent property lines

of the project site, or (2) a tree that stands in a sidewalk and is located within 50 feet of the intersection of the project's site's property line with the street frontage property line.

C. No Separate Payment. No separate payment shall be made for compliance with Plant Pest Control Requirements or Tree Protection Requirements. The cost of compliance with Plant Pest Control Requirements and Tree Protection Requirements shall be deemed included in the Contractor's bid for the Project.

3.16 PROJECT IDENTIFICATION SIGNAGE:

A. The Contractor shall provide, install and maintain Project identification and other signs where indicated to inform public and individuals seeking entrance to the Project.

B. In order to properly convey notice to persons entering upon a City construction site, the Contractor shall furnish and install a sign at the entrance (gates) as follows:

NO TRESPASSING

AUTHORIZED PERSONNEL ONLY

C. If no construction fence exists at the site, this notice shall be conveyed by incorporating the above language into safety materials (barriers, tape, and signs).

D. Provide temporary, directional signs for construction personnel and visitors.

E. Maintain and touch up signs so that they are legible at all times.

3.17 PROJECT CONSTRUCTION SIGN AND RENDERING:

A. PROJECT SIGN:

1 Responsibility: The Contractor shall produce and install one (1) project sign which shall be posted and maintained upon the site of the project at a place and in a position directed by the Commissioner. The Contractor shall protect the sign from damage during the continuance of work under the Contract and shall do all patching of lettering, painting and bracing thereof necessary to maintain the sign in first class condition and in proper position. Prior to fabrication, the Contractor shall submit an 8-1/2" x 11" color match print proof from the sign manufacturer of the completed sign for approval by the Commissioner.

2 Sign Quality: The Contractor shall provide all materials required for the production of the sign as specified herein. Workmanship shall be of the best quality, free from defects and shall be produced in a timely manner.

3 Schedule: Upon project mobilization, the Contractor shall commence production and installation of the sign.

4 Removal: At the completion of all work under the Contract, the Contractor shall remove and dispose of the project sign away from the site.

5 Sign construction:

a. Frame: The frame shall be from quality dressed 2"x2" pine, fire retardant, pressure treated lumber, that surrounds the inside back edge of the sign. The sign shall have one (1) intermediate vertical and two (2) diagonal supports, glued and screwed for rigidity. Frame shall be painted white with two (2) coats of exterior enamel paint, prior to mounting of sign panel.

b. Edging: U-shaped, 22 gauge aluminum edging, with a white enameled finish to match sign

background, shall run around entire edging of sign panel and frame. Corners shall be mitered for a tight fit. Channel dimensions shall be 1" inch (overlap to sign panel face) x 1 3/4" (or as required across frame depth) x 1" (back overlap).

c. Sign Panel: 4' x 8' panel shall be constructed in one (1) piece of 14 gauge (.0785") 6061-T6 aluminum. This panel shall be pre-finished both sides with a glossy white baked-on enamel finish and be flush with edge of 2" x 2" wood frame. Samples must be submitted for approval.

d. Fastening: Fasten sign panel to wood frame using cadmium plated no. 8 sheet metal screws at ½" below edge of panel and 8" on center. The U-shaped aluminum channel shall be applied over the wood frame edge and fastened with cadmium plated no. 8 sheet metal screws at 12" on center around the entire perimeter.

6 Sign Graphics:

a. A digital file of the project sign will be provided to the Contractor by the Commissioner's representative for printing. The Commissioner's representative shall insert the project name and names and titles of personnel (3 or more) and any other required information associated with the project. All signs may include a second panel for a project rendering as described in Sub-Section 3.17.B herein.

b. The digital file shall be reproduced at the Sign Panel size of 4' x 8' on 3M High Performance Vinyl or approved equal. The 3M High Performance Vinyl or equivalent shall be guaranteed for nine (9) years. Guarantee must cover fading, peeling, chipping or cracking. The sign manufacturer is required to maintain all specified Pantone Matching System (PMS) type and other composition elements represented in the digital file of the project sign.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SETION 3.17 B

B. PROJECT RENDERING:

1. Responsibility: In addition to the Project Sign, the Contractor shall furnish and install one (1) sign showing a rendering of the project. A digital file of the project rendering will be provided to the Contractor by the Commissioner's representative. From an approved image file provided by DDC, the Project Rendering is to be sized, printed, and mounted in an identical manner as described in Sub-Section 3.17.A above for the Project Sign. A color match print proof from the sign manufacturer of the Rendering Sign printed from the supplied file is to be submitted to DDC for approval before fabrication. The Rendering Sign is to be posted at the same height as the Project Sign. Where possible, the Rendering Sign shall be mounted with a perfect match of the short sides of the rectangle so that the Rendering Sign and the Project Sign together will create one long rectangle.

2. Removal: At the completion of all work under the Contract, the Contractor shall remove and dispose of the project rendering away from the site.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.18

3.18 SECURITY GUARDS/FIRE GUARDS ON SITE:

A. SECURITY GUARDS (WATCHMEN):

1. The Contractor shall provide competent Security Guard Service on the site, beginning on the date on which the Contractor commences actual construction work, or on such earlier date on which there is activity at the site related to the work, including without limitation, delivery of

materials or construction set-up. The Contractor shall continue to provide such Security Guard Service until the date on which it completes all required work at the site, including all punch list work, as certified in writing by the Resident Engineer, or earlier if so directed in writing by the Commissioner. Throughout the specified time period, there shall be no less than one (1) Security Guard on duty every day, including Saturdays, Sunday and Holidays, 24 hours a day, except between the hours of 8:00 A.M. and 4:00 P.M. on any day which is a regular working day for a majority of the trade subcontractors. This exception during the working day shall not apply after the finishing painting of the plaster work is commenced; thereafter, not less than one (1) Security Guard shall be on duty continuously, 24 hours a day.

2. Every Security Guard shall be required to hold a "Certificate of Fitness" issued by the Fire Department. Every Security Guard shall, during his/her tour of duty, perform the duties of Fire Guard in addition to his/her security obligations.
3. Should the Commissioner find that any Security Guard is unsatisfactory; such guard shall be replaced by the Contractor upon the written demand of the Commissioner.
4. Each Security Guard furnished by the Contractor shall be instructed by the Contractor to include in his/her duties the entire construction site including the Field Office, temporary structures, and equipment, materials, etc.
5. Should the Contractor or any other subcontractor consider the security requirements outlined above inadequate, the Contractor shall provide such additional security as it thinks necessary, after obtaining the written consent of the Commissioner. The additional cost of such approved increased protection will be paid by the Contractor.
6. Nothing contained in this Sub-Section shall diminish in any way the responsibility of the Contractor and each subcontractor for its own work, materials, tools, equipment, nor for any of the other risks and obligations outlined hereinbefore in this Article.

B. COSTS - The Contractor shall employ Security Guards/Fire Guards throughout the specified time period, except as otherwise modified by the detailed Specifications and as approved by the Commissioner, for the purpose of safeguarding and protecting the site. All costs for Security Guards/Fire Guards shall be borne by the Contractor.

C. RESPONSIBILITY - The Contractor and its subcontractors will be responsible for safeguarding and protecting their own work, materials, tools and equipment.

3.19 SAFETY:

A. The Contractor, in compliance with requirements of Section 01 35 26, SAFETY REQUIREMENTS PROCEDURES, shall provide and maintain all necessary temporary closures, guard rails, and barricades to adequately protect all workers and the public from possible injury. Any removal of these items, during the progress of the work, shall be replaced by the Contractor at no additional cost to the City.

END OF SECTION 01 50 00

SECTION 01 54 11
TEMPORARY ELEVATORS AND HOISTS

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This section includes the following:
   1. Temporary Use, Operation and Maintenance of Elevators during Construction
      a. For New buildings up to 15 Stories
      b. For New buildings over 15 Stories
      c. For Existing Buildings
   2. Temporary Construction Hoists and Hoist ways (For Material and Personnel)

1.3 RELATED SECTIONS: include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 42 00 REFERENCES
C. Section 01 50 00 TEMPORARY FACILITIES AND CONTROLS
D. Section 01 54 23 TEMPORARY SCAFFOLDS AND SWING STAGING
E. Section 01 77 00 CLOSE OUT PROCEDURES

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.1

3.1 TEMPORARY USE, OPERATION AND MAINTENANCE OF ELEVATORS DURING CONSTRUCTION FOR NEW BUILDINGS UP TO AND INCLUDING 15 STORIES:

A. INSTALLATION: The Contractor shall install, complete, operate, and maintain in good working order, as indicated herein, one (1) selected main elevator for the transport of employees of the Contractor and/or its subcontractors, and representatives of the DDC and other Governmental Agencies having jurisdiction of work at the project. The Contractor shall furnish, install, and maintain such elevator in good working order, including all necessary hoisting ropes, governor cables, traveling conductor cables, operating devices, temporary hand reset target annunciators, temporary signal devices, and all other permanent or temporary parts. The installation, operation and maintenance of the temporary elevator and all equipment and/or parts utilized in connection therewith shall be in accordance with the rules and regulations of all agencies and/or entities having jurisdiction over elevators in temporary use.

B. RESPONSIBILITY: The Contractor shall be responsible for any injury to persons or damage to property arising out of the temporary elevator and all equipment and/or parts utilized in connection therewith.

C. COSTS: The Contractor shall be responsible for all costs in connection with the temporary elevator, including without limitation: (1) installing and operating the temporary elevator, (2) maintaining the temporary elevator in clean, proper operating condition, including the cost of lubricants and/or parts for such maintenance, (3) performing all work in pits, shaft ways and machine rooms necessary for the operation of the temporary elevator, (4) replacing the temporary elevator or any equipment or parts utilized in connection therewith, if required, due to damage, destruction or excessive wear or corrosion, except for the replacement of hoisting ropes as set forth below, (5) performing all required electrical work in connection with the temporary elevator, (6) providing all electric power required to operate the temporary elevator, (7) providing all necessary conduit and wiring connections for the proper operation and signaling of the temporary elevator, and (8) providing all labor for the operation and maintenance of the temporary elevator, including on an overtime basis if necessary. The total Contract Price shall include all costs in connection with the temporary elevator, including without limitation, the costs specified herein.

D. COMMENCEMENT OF SERVICE: The Contractor shall begin to provide temporary elevator service using the selected main passenger elevator no later than eight (8) weeks (40 working days) after the machine room roof slab, or that portion of it surrounding the elevator shaft, has been placed. No later than three (3) weeks (15 working days) after the machine room roof slab, or that portion of it surrounding the elevator shaft, has been placed the following work shall have been completed:

1. The shaft shall have been completely enclosed by either the permanent or a temporary enclosure meeting the requirements of the law.
2. The machine room shall have been made completely watertight either by permanent or temporary construction. Beams or other devices, either permanent or temporary shall be provided which will enable the safe and practicable hoisting of the elevator machinery for installation.
3. There shall have been installed on all floors at the shaft way entrances to the elevator, solid substantial frames and either sliding or swing doors with substantial hardware and door locks and any necessary approved wire mesh barricades for adjacent shaft ways.
4. There shall have been furnished and installed solid substantial enclosures at front, back, sides and top of car platform enclosure, with emergency exit at top of car, excepting that the portion of the front at the elevator entrance shall have been provided with a substantial temporary door or gate.

E. ELECTRICAL INSTALLATION: The Contractor, not later than 20 calendar days after the machine room roof slab or that portion of its surrounding the elevator has been placed, shall have furnished and installed temporary or permanent power and light feeders as required for the elevator used for temporary service and shall have connected such feeders to the terminals on the starter panels or controllers in the machine room to the low voltage transformers and car light outlets in the center of shaft way and for the car control and signal traveling cables. The Contractor shall make all these required connections as soon as the equipment is declared ready for such connections by the Resident Engineer.

F. REMOVAL: When elevators for permanent use have been installed and are in condition for service, and when directed by the Commissioner, the Contractor shall remove the temporary enclosures and all temporary elevator equipment and promptly proceed with the installation of the permanent equipment as required under the Contract.

G. INSPECTION: Before temporary elevator equipment is removed, a joint inspection of the equipment shall be made by the Contractor and the Commissioner to determine the condition of this equipment upon the discontinuation of its temporary use. If this inspection deems it necessary, the Contractor shall furnish and install new governor and compensating ropes, new traveling cables and new controller parts, etc. The car and counterweight safeties shall be thoroughly cleaned of all dirt and all foreign matter, then properly lubricated and placed in good operating condition to the satisfaction of the Commissioner. If it is determined and ordered by the Commissioner that new hoist ropes are required, such ropes shall be installed and payment therefore will be made in accordance with Article 26 of the Contract.

H. REPLACEMENT: The Contractor shall furnish and install new equipment or parts for any equipment or parts of the temporary elevator installation that have been damaged, destroyed, or that indicate excessive wear or corrosion, excepting the replacement of hoisting ropes. All shaft ways, pits, motor rooms and sheave spaces used for temporary operation of elevators shall be thoroughly cleaned. Where lubricated rails are used they shall be washed down. If roller guides are used, all rust, dirt, etc., must be moved from the rails. The full cost of parts replacement, cleaning, etc., shall be borne by the Contractor except for the replacement of hoisting ropes.

I. LIMITATIONS ON USE: The temporary elevator shall not be used during its operation for the hoisting of materials or the removal of rubbish, but shall be limited only to the transportation of employees of the Contractor and/or its subcontractors, and representatives of DDC and other Governmental Agencies having jurisdiction of work at the project. However, the Resident Engineer may grant special permission at specified times to the Contractor and/or its subcontractors to hoist materials, which in the Resident Engineer's opinion will not overload or damage the elevator installation, but only after such times as all plastering has been completed from the second floor up. In the event of any damage to the temporary elevator, the Contractor shall notify the Resident Engineer within 24 hours after such damage has occurred. As indicated above, the Contractor shall be responsible for the replacement of any equipment or parts of the temporary elevator that have been damaged.

J. LIQUIDATED DAMAGES: The Contractor will be charged at the rate of $100 per day for each day it fails to provide the temporary elevator service described in this section beginning with the 41st working day after the machine room roof slab, or that portion of it surrounding the elevator shaft, has been placed and stripped. This charge will be deducted from any amount due and owing to the Contractor.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.2

3.2 TEMPORARY USE, OPERATION AND MAINTENANCE OF ELEVATORS DURING CONSTRUCTION FOR NEW BUILDING OVER 15 STORIES:

A. INSTALLATION: The Contractor shall install, complete, operate, and maintain in good working order, as indicated herein, two (2) selected main elevators for the transport of employees of the Contractor and/or its subcontractors, and representatives of the DDC and other Governmental Agencies having jurisdiction of work at the project. The Contractor shall furnish, install, and maintain such elevators in good working order, including all necessary hoisting ropes, governor cables, traveling conductor cables, operating devices, temporary hand reset target annunciators, temporary signal devices, and all other permanent or temporary parts. The installation, operation and maintenance of the temporary elevators and all equipment and/or parts utilized in connection therewith shall be in accordance with the rules and regulations of all agencies and/or entities having jurisdiction over elevators in temporary use. The two (2) elevators shall not be operated simultaneously.

B. RESPONSIBILITY: The Contractor shall be responsible for any injury to persons or damage to property arising out of the temporary elevators and all equipment and/or parts utilized in connection therewith.

C. COSTS: The Contractor shall be responsible for all costs in connection with the temporary elevators, including without limitation: (1) installing and operating the temporary elevators, (2) maintaining the temporary elevators in clean, proper operating condition, including the cost of lubricants and/or parts for such maintenance, (3) performing all work in pits, shaft ways and machine rooms necessary for the operation of the temporary elevators, (4) replacing the temporary elevators or any equipment or parts utilized in connection therewith, if required due to damage, destruction or excessive wear or corrosion, except for the replacement of hoisting ropes as set forth below, (5) performing all required electrical work in connection with the temporary elevators, (6) providing all electric power required to operate the temporary elevators, (7) providing all necessary conduit and wiring connections for the proper operation and signaling of the temporary elevators, and (8) providing all labor for the operation and maintenance of the temporary elevators, including on an overtime basis if necessary. The total Contract Price shall

include all costs in connection with the temporary elevators, including without limitation, the costs specified herein.

D. LOW RISE ELEVATOR: The Contractor shall begin to provide temporary elevator service using one (1) selected main passenger elevator no later than six (6) weeks (30 working days) after the 12th Floor slab, or that portion of it surrounding the elevator shaft, has been placed and stripped. No later than one (1) week, five (5) working days, after the 12th Floor slab, or that portion of it surrounding the elevator shaft, has been placed and stripped the following work shall have been completed:

1. The shaft shall have been completely enclosed up to the 12th Floor by either the permanent or a temporary enclosure meeting the requirements of the law.

2. A temporary machine room enclosure shall have been provided at the 11th Floor and shall have been made completely watertight either by permanent or temporary construction. Beams or other devices, either permanent or temporary, shall be provided which will enable the safe and practicable hoisting of the elevator machinery for installation.

3. There shall have been installed on all floors up to and including the 9th Floor at the shaft entrances to the elevator, solid substantial wood frames and either sliding or swing doors with substantial hardware and door locks, also any necessary approved wire mesh barricades for adjacent shaft ways.

4. There shall have been furnished and installed solid substantial enclosures at front, back, sides and top of car platform enclosure, with an emergency exit at top of car, excepting that the portion of the front at the elevator entrance shall have been provided with a substantial temporary door or gate.

E. ELECTRICAL INSTALLATION: The Contractor not later than 10 calendar days after the 12th Floor slab or that portion of it surrounding the elevator, has been poured and stripped, shall have furnished and installed temporary or permanent power and light feeders as required for the elevator used for temporary service and shall have connected such feeders to the terminals on the starter panels or controllers in the temporary machine room, to the low voltage transformers and car light outlets in the center of the shaftway and for the car control and signal traveling cables. The Contractor shall make all these required connections as soon as the Equipment is declared ready for such connections by the Resident Engineer.

F. HIGH RISE ELEVATOR: The Contractor shall begin to provide temporary elevator service to all floors, using a selected main passenger elevator, no later than eight (8) weeks (40 working days) after the machine room roof slab, or that portion of it surrounding the elevator shaft, has been placed. No later than three (3) weeks (15 working days) after the machine room roof slab, or that portion of it surrounding the elevator shaft, has been placed, the following work shall have been completed:

1. The shaft shall have been completely enclosed by either the permanent or temporary enclosure, meeting the requirements of the law.

2. The machine room shall have been made completely watertight either by permanent or temporary construction. Beams or other devices, either permanent or temporary shall be provided which will enable the safe and practicable hoisting of the elevator machinery for installation.

3. There shall have been installed on all floors at the shaft way entrances to the elevator, solid substantial frames and either sliding or swing doors with substantial hardware and door locks, also any necessary approved wire mesh barricades for adjacent shaft ways.

4. There shall have been furnished and installed, solid substantial enclosures at front, back, sides and top of car platform enclosure, with an emergency exit at top of car, excepting that the portion of the front at the elevator entrance shall have been provided with a substantial temporary door or gate.

G. ELECTRICAL INSTALLATION: The Contractor, not later than 20 calendar days after the machine room slab or that portion of it surrounding the elevator shaft has been placed, shall have furnished and installed temporary or permanent power and light feeders as required for the high rise elevator to be used for

temporary service and shall have connected such feeders to the terminals on the motor-generator starter panels or controllers in the machine room, to the signal circuits low voltage transformers for the annunciators and car light outlets in the center of shaft way. The Contractor shall make all these required connections as soon as the equipment is declared ready for such connections by the Resident Engineer.

H. When the high rise elevator is completed and ready for temporary operation, the low rise temporary elevator shall be shut down.

I. REMOVAL: When one (1) or more elevators for permanent use have been installed and are in condition for service, and when directed by the Commissioner, the Contractor shall remove the temporary enclosures and all temporary elevator equipment, and promptly proceed with the installation of the permanent equipment as required under the Contract.

J. INSPECTION: Before temporary elevator equipment is removed, a joint inspection of the equipment shall be made by the Contractor and the Commissioner to determine the condition of this equipment upon the discontinuation of its temporary use. If this inspection determines it necessary, the Contractor shall furnish and install new governor and compensating ropes, new traveling cables, new controller parts, etc. The car and counterweight safeties shall be thoroughly cleaned of all dirt and all foreign matter, then properly lubricated and placed in good operating condition to the satisfaction of the Commissioner. If it is determined and ordered by the Commissioner that new hoist ropes are required, such ropes shall be installed and payment therefore will be made in accordance with Article 26 of the Contract.

K. REPLACEMENT: The Contractor shall furnish and install new equipment or parts for any equipment or parts of the temporary elevator installations that have been damaged, destroyed, or that indicate excessive wear or corrosion, excepting the replacement of hoisting ropes. All shaft ways, pits, motor rooms and sheaves spaces used for temporary operation of elevators shall be thoroughly cleaned down. Where lubricated rails are used they shall be washed down, if roller guides are used, all rust, dirt, etc., must be removed from the rails. The full cost of parts replacement cleaning, etc., shall be borne by the Contractor except for the replacement of hoisting ropes.

L. LIMITATIONS ON USE: The temporary elevators shall not be used during their operation for the hoisting of materials or the removal of rubbish, but shall be limited only to the transportation of employees of the Contractor and/or its subcontractors, and representatives of DDC and other Governmental Agencies having jurisdiction of work at the project. However, the Resident Engineer may grant special permission at specified times to the Contractor and/or its subcontractors to hoist materials, which in the Resident Engineer's opinion will not overload or damage the elevator installation, but only after such times as all plastering has been completed from the second floor up. In the event of any damage to the temporary elevator, the Contractor shall notify the Resident Engineer within 24 hours after such damage has occurred. As indicated above, the Contractor shall be responsible for the replacement of any equipment or parts of the temporary elevator that have been damaged.

M. LIQUIDATED DAMAGES: The Contractor will be charged at the rate of $100 per day for each day it fails to provide the temporary elevator service described in this Section beginning with the 31st working day after the 12th Floor slab, or that portion of the 12th Floor slab surrounding the elevator shaft, has been placed and stripped. This charge will be deducted from any amount due and owing to the Contractor.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.3

3.3 TEMPORARY USE, OPERATION AND MAINTENANCE OF ELEVATORS DURING CONSTRUCTION FOR EXISTING BUILDINGS:

A. The Contractor may use, at the Commissioner's discretion, one (1) selected elevator in the building for temporary operation by the Contractor for the transportation of employees of the Contractor and/or its subcontractors, and representatives of DDC and other Governmental Agencies having jurisdiction over the work at the Project. The operation of the temporary elevator and all equipment and/or parts utilized in

connection therewith shall be in accordance with the rules and regulations of all agencies and/or entities having jurisdiction over elevators in temporary use.

B. RESPONSIBILITY: The Contractor shall be responsible for any injury to persons or damage to property arising out of the temporary elevator and all equipment and/or parts utilized in connection therewith.

C. REPLACEMENT: The Contractor shall furnish and install new equipment or parts for any equipment or parts of the elevator for temporary operation that have been damaged, destroyed, or that indicate excessive wear or corrosion, excepting the replacement of hoisting ropes. All shaft ways, pits, motor rooms and sheave spaces used for temporary operation of elevators shall be thoroughly cleaned down. Where lubricated rails are used they shall be washed down, if roller guides are used, all rust, dirt, etc., must be moved from the rails. The full cost of parts replacement, cleaning, etc., shall be borne by the Contractor except for the replacement of hoisting ropes. If it is determined and ordered by the Commissioner that new hoist ropes are required, such ropes shall be installed and payment therefore will be made in accordance with Article 26 of the Contract.

D. LIMITATIONS ON USE: The temporary elevator shall not be used during its operation for the hoisting of materials or the removal of rubbish, but shall be limited only to the transportation of employees of the Contractor and/or its subcontractors, and representatives of DDC and other Governmental Agencies having jurisdiction of work at the project. However, the Resident Engineer may grant special permission at specified times to the Contractor and/or its subcontractors to hoist materials, which in the Resident Engineer's opinion will not overload or damage the elevator installation. In the event of any damage to the temporary elevator, the Contractor shall notify the Resident Engineer within 24 hours after such damage has occurred. As indicated above, the Contractor shall be responsible for the replacement of any equipment or parts of the temporary elevator that have been damaged.

E. LIQUIDATED DAMAGES: The Contractor will be charged at the rate of $100 per day for each day it fails to provide elevator services described in this section beginning with 15 consecutive calendar days from Notice to Proceed. This charge will be deducted from any amount due and owing to the Contractor.

3.4 TEMPORARY HOISTS AND HOISTWAYS (FOR MATERIAL AND PERSONNEL):

A. RESPONSIBILITY: The Contractor shall provide adequate numbers of material hoists for the most expeditious performance of all parts of the work including the work of all its subcontractors. .

B. LOCATIONS: No hoists shall be constructed at such locations as will interfere with, or affect the construction of, floor arches, or the work of subcontractors. The hoists may be located at the exterior sides of the structure or in the courtyard and extend upward adjacent to the line of window openings. The hoists shall be located a sufficient distance from the exterior walls and be so protected as to prevent any of the permanent work from being damaged, stained or marred.

C. ELEVATOR SHAFT: Wherever possible, one or more of the permanent elevator shafts may be used as temporary hoist ways, providing such use complies with the requirements of the Building Code of the City of New York and has been approved by the Commissioner, and providing further it entails no interference with the progress of the work.

D. PROTECTION FOR INTERIOR HOISTS: All interior material hoist ways shall be enclosed on each floor and shall be adequately protected with appropriate safety guards. In no event shall the protection be less than that required by law.

END OF SECTION 01 54 11

SECTION 01 54 23
TEMPORARY SCAFFOLDING AND PLATFORMS

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

B. Section 01 35 26: Safety Requirements Procedures.

C. The Contractor shall comply with the requirements of "*The City of New York Department of Design and Construction Safety Requirements*". This document is included in the Information for Bidders.

1.2 SUMMARY:

A. This Section includes administrative and general procedural requirements for Temporary Scaffolding and Platforms, including:

1. Conformance
2. Responsibility
3. Jobsite Documentation and Submittals
4. Inspections

B. This Section governs ALL scaffold used on DDC project sites including, but not limited to, Suspended Scaffold, Supported Scaffold and Sidewalk Sheds.

1.3 CONFORMANCE:

A. Unless otherwise indicated, the Contractor is responsible for providing, erecting, installing and maintaining all temporary scaffolding and platforms which shall comply with requirements of Chapter 33 (Safeguards During Construction or Demolition) of the NYC Building Code, NYC Local Law 52 of 2005, OSHA Construction Standard 1926 Subpart L, and furnishing the items and personnel set forth in this section.

1.4 RESPONSIBILITY:

A. Jobsite Safety Coordinator: The Contractor shall designate and employ a Jobsite Safety Coordinator, who shall be a competent person, who shall have a daily presence on the project site during scaffold use. This designee must possess and maintain a valid New York City Department of Buildings supported scaffold certificate of completion. An alternate shall also be designated, in the event that the Jobsite Safety Coordinator is absent. The Jobsite Safety Coordinator shall:

1. Verify completeness of documentation and submittals (as described below).
2. Verify that inspections are performed, including pull tests (see below), reports are filed and reported deficiencies are corrected.
3. Monitor trades using scaffold.
4. Limit access to scaffold areas that are tagged for non-use.
5. Inform trades of scaffold load limitations.
6. Monitor loading of decks.
7. Verify that any ties that are temporarily removed are properly restored in the same shift.
8. Verify that outriggers and planks that are moved are properly set up and secured.
9. Verify that all scaffold decks in use have proper access/egress.
10. Verify that all open sides of decks in excess of 14 inches have proper guardrails and toe-boards.

11. Notify appropriate parties, including but not limited to the Resident Engineer, site safety coordinator / monitor, site safety consultant, scaffold users, contractor and the scaffold engineer, of misuses, non-conformances, hazards and accidents.
12. Keep a log of significant actions and events connected with the scaffolding.

B. The Contractor shall be responsible for erecting, maintaining and dismantling the scaffolding and/or sidewalk shed in conformance with requirements of the New York City Building Code, OSHA and the Contract documents, including the specifications. The Contractor shall also be guided by generally accepted standards of scaffold industry practice as promulgated by the Scaffold Industry Association.

C. The Contractor shall require the subcontractor responsible for erecting the scaffolding to engage a Scaffold Engineer, licensed as a professional engineer by the State of New York. The Scaffold Engineer shall be responsible to ensure the following: (1) that the installation design is in compliance with requirements of the New York City Building Code and OSHA, (2) that the design comports with the capabilities of the components and the characteristics of the site, (3) that scaffold loads on the host building, including netting, have been properly considered, and (4) that the design documents provide accurate information for erectors and users.

D. Scaffold users are trade contractors assigned to work on the scaffold. Training certificates from a New York City Department of Buildings approved training provider are mandatory. These users have the duty to become familiar with the New York City Building Code and OSHA requirements germane to users, to obey the instructions of the Jobsite Safety Coordinator and to inform the Jobsite Safety Coordinator of known hazards, non-conformances or violations.

1.5 JOBSITE DOCUMENTATION AND SUBMITTALS:

The Contractor shall prepare, obtain and submit the following to the Resident Engineer:

A. NYC Department of Buildings permit(s) for scaffold and sidewalk sheds (as applicable) including filing applications signed and sealed by a Professional Engineer licensed in the State of New York;

B. Site logistics plan / site safety plan;

C. Installation drawing(s), design and product data to be provided for **all** scaffold(s) and shed(s) must include, at a minimum:

1. Plan(s);
2. Elevation(s);
3. Duty load designation; "standard" (150 psf live load) or "heavy duty" (300 psf live load).
4. Details including base support, anchors and ties;
5. Notes and specifications including load limits, number of planked levels, tie spacing, netting, and sequence of installation and removal.
6. Anchorage into sound material.
7. Load limits based on pull tests;
8. Specifications for pull test(s), method, proof load and the number of trials;
9. Elevations, levels or heights, where anchorage is made into masonry;
10. Specifications for frames, planks, screw jacks, anchors, and any other ancillary hardware;
11. Samples for anchors, ties and netting;
12. Sequence of operations for erection and demolition;
13. Location plan, heights, widths, "jumps" over doorways and driveways;
14. Specify size, maximum span and maximum spacing of headers and stringers;
15. Specify legs, girts, braces, nailing and connections;
16. All sidewalk sheds shall be designed, engineered, signed and sealed by a Professional Engineer licensed in the State of New York;
    a. Generic (not job specific) engineering drawings are satisfactory for standard sheds and arrangements.

b. Special engineering is required for custom sheds, site-specific problems or non-standard arrangements.

1.6 INSPECTIONS:

A. Signed inspection reports shall be issued for each inspection and pull-test below, and shall be logged and maintained on site by the Jobsite Safety Coordinator for the duration of the project.

B. Pull testing shall be required during design, and during or post erection, where anchorage is made into masonry. The Scaffold Engineer shall specify the test method, proof load and the number of trials.

C. Sidewalk sheds shall be inspected after initial installation, major modification, or damage and thence every three months. Inspections shall be by a Scaffold Engineer for custom sheds and by a Competent Person employed by the Contractor for standard sheds.

D. Scaffolds shall be inspected by the Scaffold Engineer during erection, post-erection and prior to use and thence every three months. The Scaffold Engineer shall repeat inspections after major alteration/modification, damage.

E. A Qualified Person assigned by the Contractor shall inspect the progress of erection and dismantling, and the condition and integrity of the sidewalk sheds after high winds, major storms and at least once per month during usage.

F. A Qualified Person assigned by the Contractor shall inspect the progress of erection and dismantling at least weekly, and the condition and integrity of the scaffold after high winds, major storms and at least once per month during usage.

G. Scaffolds and Sidewalk Sheds shall be inspected daily by the Jobsite Safety Coordinator or alternate prior to use by scaffold users. The inspection results must be recorded in the maintenance log, and be available on-site at all times.

H. At the completion of the project, submit all inspection documents as Miscellaneous Record Documents in accordance with Section 01 78 39, CONTRACT RECORD DOCUMENTS.

1.7 LADDERS AND STAIRS:

A. The Contractor shall provide and maintain ladders or temporary stairs extending from the street to the first story, and to and from every floor and roof level of the project.

1.8 ACCESS AND EXITS:

A. The ladders or temporary stairs shall be of acceptable size, number and location, so that proper and convenient access may be had by those required to proceed to and from all parts of the project.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 54 23

SECTION 01 73 00
EXECUTION

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes general procedural requirements governing execution of the Work including without limitation the following:

1. Delivery of Materials
2. Contractor's Superintendent
3. Surveys
4. Borings
5. Examination
6. Environmental Assessment
7. Preparation
8. Deferred Construction
9. Installation
10. Permits
11. Transportation
12. Sleeves and Hangers
13. Sleeve and Hanger Drawings
14. Cutting and Patching
15. Location of Partitions
16. Furniture and Equipment
17. Removal of Rubbish and Surplus Material
18. Cleaning
19. Security And Protection of Work Site
20. Maintenance of Site and Adjoining Property
21. Maintenance of Project Site
22. Safety Precautions for Control Circuits
23. Obstructions in Drainage Lines

1.3 RELATED SECTIONS: Include without limitation the following:

A.	Section 01 10 00	SUMMARY
B.	Section 01 31 00	PROJECT MANAGEMENT AND COORDINATION
C.	Section 01 33 00	SUBMITTAL PROCEDURES
D.	Section 01 74 19	CONSTRUCTION WASTE MANAGEMENT & DISPOSAL
E.	Section 01 77 00	CLOSEOUT PROCEDURES
F.	Section 01 78 39	CONTRACT RECORD DOCUMENTS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.5 QUALITY ASSURANCE:

A. Land Surveyor Qualifications: A professional land surveyor who is licensed in the State of New York and who is experienced in providing land-surveying services of the kind indicated.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

3.1 DELIVERY OF MATERIALS:

A. Material Orders: The Contractor shall furnish to the Commissioner a copy of each material order, indicating date of order and quantity of material, and shall also notify the Commissioner when materials have been delivered to the site and in what quantities.

B. Ample Quantities: The Contractor shall deliver materials in ample quantities to insure the most prompt and uninterrupted progress of the work so as to complete the work within the Contract time.

C. Containers: The manufacturer's containers shall be delivered with unbroken seals and shall bear proper labels.

D. Deliveries: The Contractor shall coordinate deliveries in order to avoid delaying or impeding the progress of the work.

E. Handling: The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage.

1. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.
2. Promptly return damaged shipments or incorrect orders to manufacturer.
3. For materials or equipment to be reused or salvaged, use special care in removal, storage and reinstallation to insure proper function in completed work.

F. Storage: Store products in accordance with provisions of Article 3.1, and periodically inspect to assure that stored products are undamaged and are maintained under required conditions.

G. Stacking: All materials shall be properly stacked in convenient places adjacent to the site, or where directed, and protected in a satisfactory manner. Stacked materials shall be so arranged as to not interfere with visibility of traffic control devices.

H. Overloading: If authority is given to store materials in any part of the project area, they shall be so stored as to cause no overloading.

I. No Interference: If it becomes necessary to remove and restack materials to avoid impeding the progress of any part of the work or interfering with the work to be done by any trade subcontractor, the Contractor shall remove and restack such materials at no additional cost to the City.

3.2 CONTRACTOR'S CONSTRUCTION SUPERINTENDENT:

A. Contractor's Construction Superintendent: The Contractor shall devote its time and personal attention to the work and shall employ and retain at the project site, from the commencement until the entire completion of the work, a Contractor's Construction Superintendent. The Contractor's Construction Superintendent shall be registered with the New York City Department of Buildings in compliance with the Construction Superintendent Rule of the City of New York and shall be competent and capable of maintaining proper supervision and care of the work and shall be acceptable to the Commissioner. The Construction Superintendent shall, in the absence of the Contractor, and irrespective of any superintendent or foreman employed by any subcontractor, shall see that the instructions of the Commissioner are carried out.

B. Replacement: The Contractor's Construction Superintendent on the job shall not be changed or removed without the consent of the Commissioner.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.3

3.3 SURVEYS:

A. Line and Grade: The City will establish a baseline and bench mark near the site of the work for use of the Contractor in connection with the performance of the work.

B. Responsibility: The Contractor shall establish all other lines and elevations required for its work and shall be solely responsible for the accuracy thereof.

C. Safeguard All Points: The Contractor shall safeguard all points, stakes, grade marks and bench marks made or established by the Contractor on the work, shall re-establish same if disturbed and bear the entire expense of rectifying the work improperly installed due to not maintaining, not protecting or removing without authorization such established points, stakes, or marks.

D. City Monuments and Markers: No work shall be performed near City monuments or marks so as to disturb them until the said monuments or marks have been referenced or reset or otherwise disposed of by the relevant Agency or party who installed them.

E. Foundations: The Contractor shall furnish certification from a licensed Surveyor that all portions of the foundation work are located in accordance with the Contract Drawings and at the elevations required thereby. This certification shall show the actual locations and the actual elevations of all the work in relation to the locations and elevations shown on the Contract Drawings, including but not restricted to the following:

1. The locations and elevations of all piles, if any.
2. Elevations of tops of all spread footings, tops of pile caps, and tops of all foundation walls, elevator pit walls and ramp walls.
3. Location of all footing centers and pier centers including those for exterior wall columns.
4. Location of all foundation walls including wall columns, elevator pit walls and ramp walls.

F. Wall Lines: After the first courses of masonry or stone have been laid, the Contractor shall establish the permanent lines of exterior walls. The Contractor shall furnish promptly, certification from a licensed Surveyor, in the form of signed original drawings showing the exact location of such wall lines, of all portions of all structures. Except at its own risk, the Contractor shall not proceed further with the erection of walls until the Surveyor's certification has been submitted and verified for correct location of wall lines.

G. Surveyor: The Surveyor selected for any of the purposes mentioned in Paragraph E and Paragraph F above, and Paragraph I below, shall be a land Surveyor licensed in the State of New York and shall be subject to the approval of the Commissioner. The Surveyor shall not be a regular employee of the Contractor, nor shall the Surveyor have any interest in the Contract. The Surveyor shall not be employed by the Contractor in laying out any work, it being intended that the Surveyor's certification shall represent an independent and disinterested verification of such layout. The Surveyor shall report to the Department of Design and Construction's Resident Engineer each time upon arrival to and departure from the site and review with the Resident Engineer the data required for the project.

H. Final Certification: Final certification shall be submitted upon completion of the work or upon completion of any subdivision of the work as directed by the Commissioner. Any exceptions or deviations from the drawings shall be noted on the final certificate and there shall be included any maps, plates, notes, pertinent documents and data necessary, in the opinion of the Commissioner, to constitute a full and complete report.

I. Final Survey: The Contractor shall submit to DDC for submission to the Department of Buildings a final Survey by the licensed Surveyor showing the location of the new Structure, before completion of the Structure. This Survey shall show the location of the first tier of beams or of the first floor; the finish grades of the open spaces on the plot; the established curb level and the location of all other Structures on the plan, together with the location and boundaries of the lot or plot upon which the Structure is constructed, curb cuts, all yard dimensions, etc.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.4

3.4 BORINGS:

A. The work of this article shall be the responsibility of the Contractor unless otherwise indicated.

B. Reference Drawings: The Boring Drawings as listed on the title sheet are for information to the bidder and are to be used under the conditions as follows:

1. Boring Logs: shown on the Boring Drawings, record information obtained under engineering supervision in the course of exploration carried out by or under the direction of forces of the Department of Design and Construction at the site.

2. Soils and Rock Samples: All inferences are drawn from the indications observed as made by engineering and scientific personnel. All such inferences and all records of the work including soil samples and rock cores, if any, are available to bidders for inspection.

3. Certification of Samples: The City certifies that the work was carried out as stated, and that the soil samples and rock cores, if any were referred to, were actually taken from the site at the times, places and in the manner indicated. The samples are available for inspection in the Department of Design and Construction Subsurface Exploration Section.

4. Bidder's Responsibility: The bidder, however, is responsible for any conclusions to be drawn from the work. If the bidder accepts those of the City, it must do so at its own risk. If the bidder prefers not to assume such risk, the bidder is under the obligation of employing its own experts to analyze the available information, and must be responsible for any consequences of acting on their conclusions.

5. Continuity Not Guarantee: The City does not guarantee continuity of conditions shown at actual boring locations over the entire site. Where possible, borings are located to avoid all obstructions and previous construction which can be found by inspection of the surface and the bidder is required to estimate the influence of such features from its own inspection of the site.

3.5 EXAMINATION:

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground utilities and other construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with the subcontractor responsible for installation or application present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.6 ENVIRONMENTAL ASSESSMENTS:

A. City Responsibilities: An Environmental Assessment and survey is performed by the NYC DDC and its findings are included in the Contract Documents. In accordance with the NYC Administrative Code Title 15 Chapter 1 an asbestos survey is required to be performed by an Asbestos Investigator certified by the NYC Department of Environmental Protection (DEP) to identify the presence of asbestos containing material (ACM) prior to any alteration, renovation or demolition activity. The findings of such survey are required for the submission of approvals and permits issued by the NYC Department of Buildings (DOB). When the findings indicate that asbestos containing material is present and will be disturbed during the alteration, renovation or demolition activity then abatement design specifications will be incorporated into the contract documents. The Contractor shall comply with all federal, state and local asbestos regulations affecting the work for this Contract.

B. Contractor Responsibility: The Contractor shall comply with all federal, state and local environmental regulations, including without limitation USEPA and OSHA regulations which require the Contractor to assess if lead based paint will be disturbed during the work in order to protect his/her workers and the building occupants from migration of lead dust into the air. The Contractor shall comply with all federal, state and local environmental waste disposal regulation which may be required during the work. The Contractor is required to hire licensed abatement and disposal companies for the requisite work.

3.7 PREPARATION:

A. Field Measurements: The Contractor shall verify all dimensions and conditions on the job so that all work will properly join the existing work.

B. The Contractor, before commencing work, shall examine all adjoining work on which its work is in any way dependent on good workmanship in accordance to the intent of the Specifications and the Contract

Drawings. The Contractor shall report to the Commissioner any condition that will prevent it from performing work that conforms to the required standard.

C. Existing Utility Information: Furnish information to the Commissioner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

3.8 DEFERRED CONSTRUCTION:

A. Where necessity for deferred construction is certified by the Commissioner, in order to permit the installation of any item or items of equipment required to be furnished and installed concurrent with the time allowed for doing and completing the work of the Contract, the Contractor shall defer construction work limited to adequate areas as approved by the Commissioner.

B. The Contractor shall confer with the affected trade subcontractors and ascertain arrangements, time and facilities necessary to be made by the Contractor in order to execute the provisions specified herein.

3.9 INSTALLATION:

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work and work of trade subcontractors to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by the Design Consultant.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.10 PERMITS:

A. The Contractor shall comply with all local, state and federal laws, rules and regulations affecting the Work of this Project, including, without limitation, (1) obtaining all necessary permits for the performance of the Work prior to commencement thereof, and (2) complying with all requirements for the disposal of demolition and/or construction debris, waste, etc., including disposal in City landfills. The Contractor shall be responsible for all costs in connection with such regulatory compliance, unless otherwise specified in the Contract.

3.11 TRANSPORTATION:

A. Availability: It shall be the duty of the Contractor to determine the availability of transportation facilities and dockage for the use of its employees, equipment and material and the conditions under which such use will be permitted.

B. Costs: If transportation facilities and dockage are available and are permitted to be used by the governmental agency having jurisdiction, the Contractor shall pay all necessary costs and expenses, and abide by all rules and regulations promulgated in connection therewith.

C. Vehicles: With respect to the use of vehicles on highways and bridges, the Contractor's attention is directed to the limitations set forth in the Rules of the City of New York, Title 34, Chapter 4, Section 4-15.

D. Continued Use: It is understood that the Commissioner makes no warranty as to the continued use by the Contractor of such facilities.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.12

3.12 SLEEVES AND HANGERS:

A. Coordinate with Progress Schedule: The Contractor shall promptly furnish and install conduits, outlets, piping sleeves, boxes, inserts and all other materials and equipment that is to be built into the work in conformity with the requirements of the project.

B. Cooperation of Subcontractors: All subcontractors shall fully cooperate with each other in connection with the performance of the above work as "cutting in" new work is neither contemplated nor will it be tolerated.

C. Timeliness: In the event that timely delivery of sleeves and other materials cannot be made, and to avoid delay, the Contractor may arrange to have boxes or other forms set at the locations where the piping or other material is to pass through or into the slabs, walls or other work. Upon the subsequent installation of the sleeves or other material, the Contractor shall fill around them with materials as required by the Contract. The necessary expenditures incurred for the boxing out and filling in shall be borne by the Contractor.

D. Inserts: The Contractor is to install strip inserts four (4) foot on center and perpendicular to beams in ceiling slabs of boiler, machine and mechanical equipment rooms. Inserts are to be installed for strippable concrete slabs only.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.13

3.13 SLEEVE AND PENETRATION DRAWINGS:

A. As soon as practicable after the commencement of work and when the order in which concrete for the first slabs, walls, etc. to be poured is determined, the Contractor shall submit to the DDC a sketch indicating the location and size of all penetrations for sleeves, ducts, etc. which will be required to accommodate the mechanical trades, in order to determine if such penetrations will materially weaken the project's structure. The sketch shall be stamped and returned if approved and/or comments will be transmitted. The Contractor shall continue to submit sketches as the pouring schedule and the concrete work progresses and, until approvals for the penetration sketches have been given. The Contractor shall not predicate its layout work on unapproved sketches.

3.14 CUTTING AND PATCHING:

A. Responsibility: The Contractor shall do all cutting, patching and restoration required by its work, unless otherwise particularly specified in the Specifications.

B. Restore Work: The Contractor shall restore any work damaged during the performance of the work.

C. Competent Workers: All restoration work shall be done to the satisfaction of the Commissioner by competent workers skilled in the trade required by such restoration. If, in the judgment of the Commissioner, workers engaged in restoration work are incompetent, they shall be replaced immediately by competent workers.

D. Structural Elements: Do not cut and patch structural elements without the prior approval, in writing, of the Resident Engineer.

E. Operational Elements: Do not cut and patch operating elements and related components.

F. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Commissioner's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

G. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

H. Removals: The Contractor must remove from the premises all demolished materials of every nature or description resulting from cutting, patching and restoration work, in accordance with the requirements hereinafter stipulated under Sub-Section 3.17 herein and as further required in Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 3.15

3.15 LOCATION OF PARTITIONS:

A. Within three (3) weeks after the concrete slabs have been poured on each floor level, the Contractor shall immediately locate accurately all of the partitions, including the door openings, on the floor slabs in a manner approved by the Resident Engineer.

3.16 FURNITURE AND EQUIPMENT:

A. Responsibility: The Contractor is responsible for moving all loose furniture and/or equipment in all areas where the location of such furniture and/or equipment interferes with the proper performance of its work.

B. Protection: All such furniture and/or equipment must be adequately protected with dust cloths and returned to their original locations when directed to do so by the Resident Engineer.

3.17 REMOVAL OF RUBBISH AND SURPLUS MATERIALS:

A. Of the waste that is generated during demolition, as many of the waste materials as economically feasible, and as stated here, shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized. Comply with requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

B. Rubbish: Rubbish shall not be thrown from the windows or other parts of the project. Mason's rubbish, dirt and other dust-producing material shall be wetted down periodically.

C. Location: The Contractor shall clean Project site and work area daily and sweep up and deposit, at a location designated on each floor, all of its rubbish, debris and waste materials, as it accumulates and when directed by the Resident Engineer. Wood crating shall be broken up, neatly bundled, tied and stacked ready for removal and be deposited at a location designated on each floor.
   1. Comply with requirements in NYC Fire Department for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees F (27 degrees C).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

D. Laborers: The Contractor shall be responsible for the removal of all rubbish, etc., from the site. The Contractor shall remove from the designated locations all piles of rubbish, debris, waste material and wood crating as they accumulate and when directed by the Resident Engineer, and shall remove them from the site. The Contractor shall employ and keep engaged for this purpose an adequate number of laborers.

E. Surplus Materials: The Contractor shall remove from the site all surplus materials when there is no further use for same.

F. Tools And Materials: At the conclusion of the work, all erection plant, tools, temporary structures and materials belonging to the Contractor shall be promptly removed.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

3.18 CLEANING:

A. The Contractor shall thoroughly clean all equipment and materials furnished and installed and shall deliver such materials and equipment undamaged in a clean and new appearing condition up to date of Final Acceptance.

B. Site: Maintain Project site free of waste materials and debris.

C. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

D. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration up to date of Final Acceptance.

F. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration up to date of Final Acceptance.

3.19 SECURITY AND PROTECTION OF WORK SITE:

A. Provide protection of installed work, including appropriate protective coverings and maintain conditions that ensure installed Work is without damage or deterioration up to date of Final Acceptance.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Secure and protect work and work site against damage, loss, injury, theft and/or vandalism.

D. Maintain daily sign-in sheets of workers and visitors and make the sheets available to the Commissioner

3.20 MAINTENANCE OF SITE AND ADJOINING PROPERTY:

A. The Contractor shall take over and maintain the Project site, after order to start work.

B. The Contractor shall be responsible for the safety of the adjoining property, including sidewalks, paving, fences, sewers, water, gas, electric and other mains, pipes and conduits etc. until the date of Final Acceptance. The Contractor shall, at its own expense, except as otherwise specified, protect same and maintain them in at least as good a condition as that in which the Contractor finds them.

C. All pavements, sidewalks, roads and approaches to fire hydrants shall be kept clear at all times, maintained and repaired to serviceable condition with materials to match existing.

D. Provide and keep in good repair all bridging and decking necessary to maintain vehicular and pedestrian traffic.

E. The Contractor shall also remove all snow and ice as it accumulates on the sidewalks within the Contract Limits Lines.

3.21 MAINTENANCE OF PROJECT SITE:

A. The Contractor shall take over and maintain all project areas, after order to start work.

B. Until the date of Final Acceptance, the Contractor shall be responsible for the safety of all project areas, including water, gas, electric and other mains and pipes and conduits and shall at the Contractor's own expense, except as otherwise specified, protect same and maintain them in at least as good condition as that in which the Contractor finds them.

C. All pavements, sidewalks, roads and approaches to fire hydrants shall be kept clear at all times, maintained, and if damaged, repaired to serviceable conditions with materials to match existing.

D. The Contractor shall keep the space for the Resident Engineer in a clean condition.

3.22 SAFETY PRECAUTIONS FOR CONTROL CIRCUITS:

A. Control circuits, the failure of which will cause a hazard to life and property, shall comply with the New York City Dept. of Buildings, Bureau of Electrical Control requirements.

3.23 OBSTRUCTIONS IN DRAINAGE LINES:

A. The Contractor shall be responsible for all obstructions occurring in all drainage lines, fittings and fixtures after the installations and cleaning of these drainage lines, fittings and fixtures as certified by the Resident Engineer. Roof drains shall be kept clear of any and all debris. Any stoppage shall be repaired immediately at the expense of the Contractor.

END OF SECTION 01 73 00

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This section includes administrative and procedural requirements for the management and disposal of construction waste and includes the following requirements:
   1. Waste Management Goals
   2. Waste Management Plan
   3. Progress Reports
   4. Progress Meetings
   5. Management Plan Implementation

B. This Section includes:
   1. Definitions
   2. Waste Management Performance Requirements
   3. Reference Resources
   4. Submittals
   5. Quality Assurance
   6. Waste Plan Implementation
   7. Additional Demolition and Salvage Requirements
   8. Disposal

1.3 RELATED SECTIONS: Include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 31 00 PROJECT MANAGEMENT AND COORDINATION
C. Section 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION
D. Section 01 73 00 EXECUTION
E. Section 01 77 00 CLOSEOUT PROCEDURES
F. Section 01 78 39 CONSTRUCTION RECORD DOCUMENTS
G. Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk or the like.

D. Construction and Demolition Waste: Solid wastes typically including building materials, trash debris and rubble resulting from remodeling, repair and demolition operations. Hazardous materials and land clearing waste are not included.

E. Diversion from Landfill: To remove, or have removed, from the site for recycling, reuse or salvage, material that might otherwise be sent to a landfill.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product.

G. Recycle (recycling): To sort, separate, process, treat or reconstitute solid waste and other discarded materials for the purpose of redirecting such materials into the manufacture of useful products. Recycling does not include burning, incinerating or thermally destroying waste.

H. Return: To give back reusable items or unused products to vendors.

I. Reuse: To reuse excess or discarded construction material in some manner on the Project site.

J. Salvage: To remove a waste material from the Project site for resale or reuse.

K. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable and reusable material.

L. Waste Management Plan: A project-related plan for the collection, transportation and disposal of waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material becoming landfill.

1.5 WASTE MANAGEMENT PERFORMANCE REQUIREMENTS:

A. The City of New York has established that this project shall generate the least amount of waste possible and that processes that ensure the generation of as little waste as possible due to error, inaccurate planning, breakage, mishandling, contamination, or other factors shall be employed.

B. Of the waste that is generated during demolition, as many of the waste materials as economically feasible, and as stated here, shall be reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

REFER TO THE ADDENDUM FOR THE APPLICABILITY OF SUB-SECTION 1.5 C

C. LEED CERTIFICATION: The City of New York will seek LEED (Leadership in Energy and Environmental Design) certification for this Project as indicated in the Addendum to the General Conditions from the U.S. Green Building Council. The documentation required here will be used for this purpose. LEED awards points for a variety of sustainable design measures on a project, one of which is the reuse and recycling of project waste.

D. DIVERSION REQUIREMENTS. A minimum of 75% of total Project demolition waste (by weight) shall be diverted from landfill. The following waste categories are likely candidates to be included in the diversion plan as applicable for this project:

1. Concrete
2. Bricks
3. Concrete masonry units (CMU)
4. Asphalt
5. Metals (e.g. banding, stud trim, ceiling grid, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, brass, bronze)

6. Clean dimensional wood
7. Carpet and pad
8. Drywall
9. Ceiling tiles
10. Cardboard, paper and packaging
11. Reuse items indicated on the Drawings and/or elsewhere in the Specification

E. All fluorescent lamps, HID lamps and mercury-containing thermostats removed from the site shall be recycled.

F. Recycling on the job, subject to the Commissioner's approval, is encouraged on the site itself, such as the crushing and reuse of removed sound concrete and stone. Include these categories in the Waste Management Plan.

1.6 REFERENCES, RESOURCES:

A. DDC encourages its contractors to seek information from websites and experts in salvage or recycling in order to minimize disposal costs. There are numerous opportunities to sell, salvage, or to donate materials and accrue tax benefits (which would accrue to the contractor); also there are outlets that will pick up, and in some cases buy recyclable materials. Examples of information resources are as follows:

1. DDC's Sustainable Design web site: http://www.nyc.gov/html/ddc/html/design/sustainable_home.shtml This includes a manual on Construction and Demolition Waste Reduction and Recycling, a Sample Waste Management Plan and sample C&D Waste Management log. A standard Construction and Demolition Waste Management Log form is included at the end of this section.

2. Web Resources

(Information only; no warranty or endorsement is implied.)

www.wastematch.org Site of New York Waste Match, a materials exchange database and service

www.bignyc.org Site of Build It Green NYC, a non profit outlet for salvaged and surplus building materials

www.usgbc.org Site of the United States Green Building Council, with a description of the LEED certification process and requirements for C&D waste recycling

www.epa.gov/epawaste/index.htm Site of the U.S. Environmental Protection Agency that discusses construction and demolition waste issues, and links to other resources.

1.7 SUBMITTALS:

A. The Contractor shall be responsible for the development and implementation of a Waste Management Plan for the Project. The Contractor's subcontractors shall assist in the development of that Plan, and collect and deposit their waste and recyclable materials in accordance with the approved Plan.

B. DRAFT WASTE MANAGEMENT PLAN. Within fifteen (15) days after receipt of 'Notice to Proceed', or prior to any waste removal, whichever occurs sooner, the Contractor shall submit to the Commissioner a Draft Waste Management Plan. Include separate sections for demolition and construction waste. The Plan shall demonstrate how the performance goals will be met, and contain the following:

1. List of materials targeted for reuse, salvage, or recycling, and names, addresses, and phone numbers of receiving facilities/companies that will be purchasing or accepting each material.
2. Description of onsite and/or offsite sorting methods for all materials to be removed from site.
3. If mixed construction and demolition waste is to be sorted off-site, provide a letter from the processor stating the average percentage of mixed construction and demolition waste they recycle.
4. Landfill information: Names of landfills where non-recyclable/reusable/salvageable waste will be disposed, and list of applicable tipping fees.
5. Materials handling procedures: A description of the means by which any recyclable, salvaged, or reused materials will be protected from contamination, and collected in a manner that will meet the requirements for acceptance by the designated recycling processors.
6. Transportation: A description of the means of transportation and destination for recycled materials.
7. Meetings: Description of regular meetings to be held to address waste management.
8. Sample spreadsheet and description of how the implementation of the plan will be documented on a monthly basis.

C. FINAL WASTE MANAGEMENT PLAN. Within fifteen (15) days of Commissioner's approval of the Draft Plan, the Contractor shall submit a Final Waste Management Plan.

D. PROGRESS REPORTS. The Contractor shall submit monthly a Waste Management Progress Report, containing the following information:

1. Project title, name of company completing report, and dates of period covered by the report
2. Report on the disposal of all jobsite waste. A DDC C&D Waste Management Log form is available on the DDC Sustainable Design website and included at the end of this section. For each shipment of material removed from the site, provide the following:
   a. Date and ticket number of removal
   b. Identity of material hauler
   c. Material Category
   d. Total quantity of waste, in tones/cubic yards, by type
   e. Quantity of waste salvaged, recycled and/or reused, by type
   f. Total quantity of waste diverted from landfill (recycled, salvaged, reused) as a percentage of total waste
   g. Recipient of each material type
3. Provide monthly and cumulative project totals of waste, quantity diverted, and percentage diverted.
4. Note that the unit of measure may be either tons or cubic yards, but must be consistent for all shipments and all materials throughout the project. Reports with inconsistent or mixed units will not be reviewed and will be returned for re-submission.
5. Include legible copies of on-site logs, weight tickets and receipts. Receipts shall be from charitable organizations, recycling and/or disposal site operators who can legally accept the materials for the purpose of reuse, recycling or disposal. Contractor shall save such original documents for the life of the project plus seven (7) years.

E. LEED Submittal: For LEED designated projects submit LEED Letter Template for Credit 2.2, signed by the Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.

F. Refrigerant Recovery. Submit Qualification data for Refrigerant recovery technician. Statement of refrigerant recovery, signed by the refrigerant recovery technician responsible for recovering refrigerant

stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.8 QUALITY ASSURANCE:

A. The Contractor shall designate a Waste Management Coordinator, to ensure compliance with this section. Coordinator shall be present at Project site full time for the duration of the project.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste management plans, documentation and implementation shall be discussed at the following meetings:

1. Pre-demolition kick-off meeting
2. Pre-construction kick-off meeting
3. Regular job-site meetings
4. Contractor toolbox meetings

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

3.1 WASTE PLAN IMPLEMENTATION:

A. The Contractor shall implement the Waste Management Plan, coordinate the Plan with all affected trades, and designate one individual as the Construction Waste Management Representative, who will be responsible for communicating the progress of the Plan with the Commissioner on a regular basis, and for assembling the required LEED documentation.

B. The Contractor shall be responsible for the provision of containers and the removal of all waste, non-returned surplus materials, and rubbish from the site in accordance with the approved Waste Management Plan. The Contractor shall oversee and document the results of the Plan. Monies received for salvaged materials shall remain with the Contractor, except the monies for those items specifically identified elsewhere in the specifications, or indicated on the drawings as belonging to others.

C. Responsibilities of Subcontractors: Each subcontractor shall be responsible for collecting its waste, non-returned surplus materials, and rubbish, in accordance with the Waste Management Plan.

D. Distribution. The Contractor shall distribute copies of the Waste Management Plan to each Subcontractor, Resident Engineer, Construction Manager, and Commissioner.

E. Instruction: The Contractor shall provide on-site instruction of proper waste management procedures to be used by all parties in appropriate stages of the Project.

F. Procedures. Conduct waste management operations to ensure minimum interference with site vegetation, roads, streets, walks and other adjacent occupied and used facilities.

1. Collect co-mingled waste and/or separate all recyclable waste in accordance with the Plan Specific areas on the Project site are to be designated, and appropriate containers and bins clearly marked with acceptable and unacceptable materials.
2. Inspect containers and bins for contamination and remove contaminated materials if found.

3. Comply with the General Conditions for controlling dust and dirt, environmental protection, and noise control.

3.2 ADDITIONAL DEMOLITION AND SALVAGE REQUIREMENTS:

A. Demolition and salvage of additional items indicated in other sections of the Project Specifications require special attention as part of the overall 75 % diversion from landfill. Specific requirements for special attention are designated in other sections of the Project Specifications.

3.3 DISPOSAL:

A. General. Except for items or material to be salvaged, recycled or otherwise reused, remove waste material from the Project site and legally dispose of them in a manner acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning. Do not burn waste materials

C. Disposal. Transport waste materials off Project Site and legally dispose of them.

END OF SECTION 01 74 19

NEW YORK CITY DEPARTMENT OF DESIGN + CONSTRUCTION

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT LOG

Project Name: _____
Project I.D.: _____

Contractor: _____
Prepared by: _____
For Month: _____

Haul Date	Ticket #	Hauling Company	*Material Category[2]	Material Quantity (tons or cubic yards)[1]				*Material Recipient
				*Total Weight	Excluded Material[3]	*Diverted Material[4]	*Landfilled Material	
				*Total		*Diverted	*Landfilled	
			Monthly Totals					
			% Diverted this Month*					
			Cumulative Totals					
			% Diverted to Date					

Notes:
1. Volume (cubic yards) may be used instead of weight if used for ALL amounts and ALL materials.
2. Includes concrete; bricks; concrete masonry units (CMU); asphalt; metals; clean dimensional wood; carpet and pad; drywall; ceiling tiles; cardboard, paper, and packaging; and any other reuse items indicated on the Drawings and/or elsewhere in the Specification.
3. Excluded material includes soil or land clearing debris.
4. Diverted material includes recycled and reused material diverted from landfill. Recycled material is reprocessed into new products. Reused material is reclaimed, salvaged or otherwise used in its original form, either on-site or off-site.

* These items must be listed in order to receive LEED credit.

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes administrative and general procedural requirements for Closeout Procedures, including without limitation the following:

1. Definitions
2. Substantial Completion
3. Final Acceptance
4. Warranties
5. Final Cleaning
6. Repair of the Work

B. LEED: Refer to the Addendum to identify whether this project is designed to comply with a Certification Level according to the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) Rating System, as specified in Section 01 81 13, "SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS."

C. COMMISSIONING: Refer to the Addendum to identify whether this project will be commissioned by an independent third party under separate contract with the City of New York. Commissioning shall be in accordance with ASHRAE and USGBC LEED- NC procedures, as described in Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS. The Contractor shall cooperate with the commissioning agent and provide whatever assistance is required.

1.3 RELATED SECTIONS: include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 33 00 SUBMITTAL PROCEDURES
C. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT & DISPOSAL
D. Section 01 78 39 CONTRACT RECORD DOCUMENTS
E. Section 01 79 00 DEMONSTRATION AND OWNER'S PRE-ACCEPTANCE ORIENTATION

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or

combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Substantial Completion: shall mean the written determination by the Commissioner that the Work required under the Contract is substantially, but not entirely, complete.

D. Final Acceptance: shall mean final written acceptance of all the Work by the Commissioner, a copy of which shall be sent to the Contractor.

1.5 SUBSTANTIAL COMPLETION:

A. Preliminary Procedures: Before requesting inspection to determine the date of Substantial Completion, the Contractor shall complete and supply all items required by the contract specifications, General Conditions, Addendum to the General Conditions, change orders or other directives from the Commissioner's representatives. The required items will include all contract requirements for substantial completion, including but not limited to items related to releases, regulatory approvals, warranties and guarantees, record documents, testing, demonstration and orientation, final clean up and repairs, and all specific checklist of items by the Resident Engineer. (See Attachment "A" at the end of this section for sample requirements for Substantial Completion).

B. Prepare and submit a list to the Resident Engineer of incomplete items, the value of incomplete construction, and reasons the work is not complete.

C. Inspection: The Contractor shall submit to the Resident Engineer a written request for inspection for Substantial Completion. Within ten (10) days of receipt of the request, the Resident Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. The Resident Engineer may request the services, as required, of the Design Consultant, Client Agency Representative and/or other entities having involvement with the Work to assist in the inspection of the Work .If the Resident Engineer makes a determination that the work is substantially complete and approves the Final Punch List and the date for Final Acceptance, he/she will so advise the Commissioner and recommend issuance of the Certificate of Substantial Completion. If the Resident Engineer determines that the work is not substantially complete, he/she will notify the Contractor of those items that must be completed or corrected before the Certificate of Substantial Completion will be issued.

1 Re-inspection: Contractor shall request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2 Results of completed inspection will form the basis of requirements for Final Acceptance.

1.6 FINAL ACCEPTANCE:

A. Preliminary Procedures: Before requesting final inspection for Final Acceptance of the Work, the Contractor shall complete the following. (Note that the following are to be completed, submitted as appropriate, and approved by the Commissioner, as applicable, prior to the final inspection and are not to be submitted for approval or otherwise at the final inspection unless specifically indicated). List exceptions in the request.

1. Verify that all required submittals have been provided to the Commissioner including but not limited to the following:
   a. Manufacturer's cleaning instructions
   b. Posted instructions
   c. As-built Record Documents (Drawings, specifications, and product data) as described in Section 01 78 39, CONTRACT RECORD DOCUMENTS, incorporating any changes required by the Commissioner as a result of the review of the submission prior to the pre-final inspection.
   d. Operation and Maintenance Manuals, including Preventive Maintenance, Special Tools, Repair Requirements, Parts List, Spare Parts List, and Operating Instructions.

e. Completion of required Demonstration and Orientation, as applicable, of designated personnel in operation and maintenance of systems, sub-systems and equipment.
f. Applicable LEED Building submittals as described in Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS.
g. Construction progress photographs as described in Section 01 32 33, PHOTOGRAPHIC DOCUMENTATION.

2. Submit a certified copy of the final approved Punch List of items to be completed or corrected. The certified copy of the Punch List shall state that each item has been completed or otherwise resolved for acceptance, and shall be endorsed and dated by the Contractor.
3. Submit pest-control final inspection report and survey as required in Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.
4. Submit record documents and similar final record information.
5. Deliver tools, spare parts, extra stock and similar items.
6. Complete final clean-up requirements including touch-up painting of marred surfaces.
7. Submit final meter readings for utilities, as applicable, a measured record of stored fuel, and similar data as of the date when the City took possession of and assumed responsibility for corresponding elements of the work.

B. Final Inspection: The Contractor shall submit to the Resident Engineer a written request for inspection for Final Acceptance of the Work. Within ten (10) days of receipt of the request, the Resident Engineer will either proceed with inspection or notify the Contractor of unfulfilled requirements. The Resident Engineer may request the services, as required, of the Design Consultant, Client Agency Representative and/or other entities having involvement with the Work to assist in the inspection of the Work. If the Resident Engineer finds that all items on the Final Approved Punch List are complete and no further work remains to be done, he/she will so advise the Commissioner and recommend the issuance of the determination of Final Acceptance. If the Resident Engineer determines that the work is not complete, he/she will notify the Contractor of those items that must be completed or corrected before the determination of Final Acceptance will be issued.

C. Final Acceptance: The Work will be accepted as final and complete as of the date of the Resident Engineer's inspection if, upon such inspection, the Resident Engineer finds that all items on the Punch List are complete and no further Work remains to be done. The Commissioner will then issue a written determination of Final Acceptance.

1.7 WARRANTIES:

A. The items of materials and/or equipment for which manufacturer warranties are required are listed in Schedule B of the Addendum. For each item of material and/or equipment listed in Schedule B, the Contractor shall obtain a written warranty from the manufacturer. Such warranty shall provide that the material or equipment is free from defects for the period set forth in Schedule B and will be replaced or repaired within such specified period. The contractor shall deliver all required warranties to the Commissioner.

B. Unless indicated otherwise Warranties are to take effect on the date of Substantial Completion.

C. Submittal Time: Submit written Warranties on request of the Commissioner for designated portions of the Work where commencement of Warranties other than date of Substantial Completion is indicated.

D. Partial Occupancy: Submit properly executed Warranties to the Commissioner within 15 days of completion of designated portions of the Work that are completed and occupied or used by the City.

E. Organize the Warranty documents into an orderly sequence based on the Project Specification Divisions and Section Numbers.

1. Bind Warranties in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES;" name and location of Project; Capitol Budget Project Number (FMS ID); and Contractor's and applicable subcontractor's name and address.
3. Provide heavy paper dividers with plastic-covered tabs for each separate Warranty. Mark tab to identify the product or installation.
4. Provide a typed description of each product or installation being warranted, including the name of the product, and the name, address, and telephone number of the Installer.

F. When warranted materials and/or equipment require operation and maintenance manuals, provide additional copies of each required Warranty in each required manual. Refer to Section 01 78 39, CONTRACT RECORD DOCUMENTS, for requirements of Operation and Maintenance Manuals.

PART II – PRODUCTS

2.1 MATERIALS:

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART III – EXECUTION

3.1 FINAL CLEANING:

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations, as applicable, before requesting inspection for Final Acceptance of the Work for entire Project or for a portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

t. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests, as required in Section 01 50 00, TEMPORARY FACILITIES,SERVICES AND CONTROLS. Prepare and submit a Pest Control report to the Commissioner.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on City's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 REPAIR OF THE WORK:

A. Subject to the terms of the Contract the Contractor shall complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Contractor shall repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 77 00

ATTACHMENT 'A'

The following list is a general sample of Substantial Completion requirements, including but not limited to:

1. Prepare and submit a list to the Resident Engineer, of incomplete items, the value of incomplete construction, and reasons the work is not complete.
2. Obtain and submit any necessary releases enabling the City unrestricted use of the project and access to services and utilities.
3. Regulatory Approvals: Submit all required documentation from applicable Governing Authorities, including, but not limited to, Department of Buildings (DoB); Department of Transportation (DoT); Department of Environmental Protection (DEP); Fire Department (FDNY); etc. Documentation to include, but not limited to, the following:
   a. Building Permits, Applications and Sign-offs.
   b. Permits and Sign-off for construction fences; sidewalk bridges; scaffolds, cranes and derricks; utilities; etc.
   c. Certificates of Inspections and Sign-offs.
   d. Required Certificates and Use Permits.
   e. Certificate of Occupancy (C.O.), Temporary Certificate of Occupancy (T.C.O.) or Letter of Completion as applicable.
4. Submit specific warranties required by the specifications, final certifications, and similar documents.
5. Prepare and submit Record Documents as described in Section 01 78 39, CONTRACT RECORD DOCUMENTS, including but not limited to; approved documentation from Governing Authorities; as-built record drawings and specifications; product data; operation and maintenance manuals; Final Completion construction photographs; damage or settlement surveys; final property surveys; and similar final record information. The Resident Engineer will review the submission and provide appropriate comments. If comments are significant the initial submission will be returned to the Contractor for correction and re-submission incorporating the comments prior to the Final Inspection.
6. Record Waste Management Progress Report: Submit C&D Waste Management logs, with legible copies of weight tickets and receipts required in accordance with Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
7. If applicable submit LEED Letter Template in accordance with the requirements of Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS.
8. Schedule applicable Demonstration and Orientation required in other Sections of the Project Specifications and as described in Section 01 79 00, DEMONSTRATION AND OWNER'S PRE-ACCEPTANCE ORIENTATION.
9. Deliver tools, spare parts, extra materials, and similar items to location designated by Resident Engineer. Label with manufacturer's name and model number where applicable.
10. Make final changeover of permanent locks and deliver keys to the Resident Engineer. Advise Commissioner of changeover in security provisions.
11. Complete startup testing of systems as applicable.
12. Submit approved test/adjust/balance records.
13. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements as directed by the Resident Engineer.
14. If applicable complete Commissioning requirements as defined in Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS.
15. Complete final cleaning requirements, including touchup painting.
16. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

SECTION 01 78 39
CONTRACT RECORD DOCUMENTS

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes administrative and general procedural requirements for Contract Record Documents, including:
   1. As-built Contract Record Drawings.
   2. As-built marked-up copies of Record Specifications, addenda and Change Orders.
   3. As-built marked-up Product Data
   4. Record Samples
   5. Construction Record Photographs
   6. Operating and Maintenance Manuals
   7. Final Site Survey
   8. Guarantees and Warranties
   9. Waste Disposal Documentation
   10. LEED Materials and Matrix
   11. Miscellaneous Record Submittals

B. The Department of Design and Construction, at the start of construction (kick-off meeting), will furnish to the Contractor at no cost a complete set of Contract Drawings Mylars (reproducible) pertaining to the work to be performed under the Contract. It is the responsibility of the Contractor to modify the Contract Drawings to indicate all changes and corrections, if any, occurring in the work as actually installed. The Contractor is required to furnish all other Mylar (reproducible) drawings, if necessary, such as Addenda Drawings and Supplementary Drawings as may be necessary to indicate all work in detail as actually completed. All professional seals must be blocked out. Title box complete with project title and Design Consultants' names will remain.

C. Maintenance of Documents and Samples: The Contractor shall maintain, during the progress of the work, an accurate record of the work as actually installed, on Contract Record Drawings, on Mylar (reproducible), in ink. Store record documents and samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition. Make documents and samples available at all times for the Resident Engineer's inspections.

   The Contractor's attention is particularly directed to the necessity of keeping accurate records of all subsurface and concealed work, so that the Contract Record Drawings contain this information in exact detail and location. Contract Record Drawings shall also show all connections, valves, gates, switches, cut-outs and similar operating equipment.

   For projects designated to achieve a LEED rating the Contractor shall receive a copy of the project's LEED scorecard for the purpose of monitoring compliance with the target objectives and to facilitate coordination with the LEED Consultant. The Contractor shall receive periodic updates of this scorecard,

and is required to submit the final version of the Scorecard at Substantial Completion with other project Record Documents.

1.3 RELATED SECTIONS: include without limitation the following:

A.	Section 01 10 00	SUMMARY
B.	Section 01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
C.	Section 01 32 33	PHOTOGRAPHIC DOCUMENTATION
D.	Section 01 33 00	SUBMITTAL PROCEDURES
E.	Section 01 77 00	PROJECT CLOSEOUT PROCEDURES

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.5 SUBMITTALS:

A. As-Built Contract Record Drawings: Comply with the following:

1. Progress Submission: As directed by the Resident Engineer, submit progress As-Built Contract Record Drawings at the 50% Construction Completion stage.

2. Final Submission: Before substantial completion payment, the Contractor shall furnish to the Commissioner one (l) complete set of marked-up Mylar (reproducible) As-Built Contract Record Drawings, in ink indicating all of the work and locations as actually installed, plus one (1) set of paper prints which will be furnished to the sponsoring agency by DDC.

3. As-Built Contract Record Drawings shall be of the same size as that of the Contract Drawings, with a one (1) inch margin on three (3) sides and a two (2) inch margin on the left side for binding.

4. Each As-Built Contract Record Drawing shall bear the legend "AS-BUILT CONTRACT RECORD DRAWING" in heavy block lettering, one half (l/2) inch high, and contain the following data:

AS-BUILT CONTRACT RECORD DRAWING
Contractor's Name _____
Contractor's Address _____
Subcontractor's Name (where applicable) _____
Subcontractor's Address _____
Made by: Date _____
Checked by: Date _____

Commissioner's Representatives
(Resident Engineer) DDC
(Plumbing Inspector) DDC
(Heating & Ventilating Inspector) DDC
(Electrical Inspector) DDC

5. Record Drawing Title Sheet: The Contractor shall prepare a title sheet, the same size as the Contract Record Drawings, which shall contain the following:

   a. Heading:
      The City of New York
      Department of Design and Construction
      Division of Public Buildings
   b. Capital Budget Project Number (FMS ID)
   c. Name and Location of Project
   d. Contractor's Name and Address
   e. Subcontractor's Name and Address (where applicable)
   f.. Record of changes (a caption description of work affected, and the date and number of Change Order or other authorization)
   g.. List of Record Drawings

B. Record Specifications, Addenda and Change Order: Submit to the Commissioner two (2) copies each of marked-up Record Specifications, Addenda and Change Orders.

C. Record Product Data: Submit to the Commissioner two (2) sets of Record Product Data.

D. Record Construction Photographs: Submit to the Commissioner final as-built construction photographs and negatives of the completed work as described in Section 01 32 33, PHOTOGRAPHIC DOCUMENTATION.

E. Operating and Maintenance Manuals:

1. Submit three (3) copies each of preliminary manuals to the Resident Engineer for review and approval. The Contractor shall make such corrections, changes and/or additions to the manual until deemed satisfactory by the Resident Engineer. Deliver three (3) copies of the final approved manuals to the Resident Engineer for distribution.

2. Commissioning: Comply with the requirements of Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS, as well as the requirements set forth in sections of the Project Specifications, for projects designated for Commissioning. Submit four (4) copies each of data designated to be included in the Commissioning Operation and Maintenance Manual to the Resident Engineer. The Resident Engineer will forward such data to the Commissioning Authority/Agent (CxA) for review and comment. The Contractor shall make such corrections, changes and/or additions to the data until deemed satisfactory and deliver four (4) copies of the final data to the Resident Engineer for use by the Commissioning Authority/Agent (CxA) to prepare the Commissioning Operation and Maintenance Manual.

   a. Non-Commissioning Data: All remaining data not designated for Commissioning and required as part of Maintenance and Operation Manual shall be prepared and assembled in accordance with the requirements of this section for Operating and Maintenance Manuals.

F. Final Site Survey: Submit Final Site Survey as described in Section 01 73 00, EXECUTION, in quantities requested by the Commissioner, signed and sealed by a Land Surveyor licensed in the State of New York.

G. Guarantees and Warranties.

H. Waste Disposal Documents and Miscellaneous Record Documents.

PART II – PRODUCTS

2.1 CONTRACT RECORD DRAWINGS:

A. Record Prints: The Contractor shall maintain one set of blue- or black-line white prints as applicable of the Contract Drawings and Shop Drawings. If applicable, the Record Contract Drawings and Shop Drawings shall incorporate the arrangement of the work based on the accepted Master Coordination Drawing(s) as described in Section 01 33 00, SUBMITTAL PROCEDURES.

1. Preparation: The Contractor shall mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
2. Change Orders: All changes from Contract Drawings shall be distinctly encircled and identified by Change Order number correlating to changes listed on the "Title Sheet." The Contractor shall show within the encircled areas the work as actually installed.

B. Content: Types of items requiring marking include, but are not limited to, the following:

1. Dimensional changes to Drawings.
2. Revisions to details shown on Drawings.
3. Depths of foundations below first floor.
4. Locations and depths of underground utilities.
5. Revisions to routing of piping and conduits.
6. Revisions to electrical circuitry.
7. Actual equipment locations.
8. Duct size and routing.
9. Locations of concealed internal utilities.
10. Changes made by Change Order
11. Changes made following Commissioner's written orders.
12. Details not on the original Contract Drawings.
13. Field records for variable and concealed conditions.
14. Record information on the Work that is shown only schematically.

C. Progress Record Mylar's (reproducible): As directed by the Resident Engineer at 50% construction completion, review marked-up Record Prints with the Resident Engineer and the Design Consulting. When directed by the Resident Engineer transfer progress mark-ups to a full set of Mylar's (reproducible) and submit one blue line or black line record copy to the Resident Engineer. The marked-up Mylar's (reproducible) shall be retained by the contractor for completion of mark-up and final submission.

D. Final Contract Record Mylar's (reproducible): Immediately before final inspection for Certificate of Substantial Completion, review marked-up Record Prints with the Resident Engineer and the Design Consulting. When authorized, complete mark-up of a full set of corrected Mylar's (reproducible) of the Contract Drawings.

1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.
2. Refer instances of uncertainty to Resident Engineer for resolution.
3. Print the As-Built Contract Drawings and Shop Drawings for use as Record Transparencies as described in Sub-Section 1.5.

2.2 RECORD SPECIFICATIONS, ADDENDA AND CHANGE ORDERS:

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders and Record Drawings where applicable.
6. Upon completion of mark-up, submit two (2) complete copies of the marked-up Record Specifications to the Commissioner.

2.3 RECORD PRODUCT DATA:

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. If possible, a Change Order proposal should include resubmitting updated Product Data. This eliminates the need to mark up the previous submittal.
4. Note related Change Orders and Record Drawings where applicable.
5. Upon completion of mark-up submit to the Commissioner two (2) sets of the marked-up Record Product Data.
6. Where Record Product Data is required as part of Maintenance Manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data.

2.4 RECORD SAMPLE SUBMITTAL:

A. Prior to the date of Substantial Completion, the Contractor shall meet with the Resident Engineer at the site to determine which of the Samples maintained during the construction period shall be transmitted to the Commissioner for record purposes.

B. Comply with the Resident Engineer's instructions for packaging, identification marking and delivery to DDC. Dispose of other samples as specified for disposal of surplus and waste material.

2.5 OPERATING AND MAINTENANCE MANUALS:

A. The Contractor shall provide preliminary and final versions of Operating and Maintenance Manuals required for those systems, equipment and materials listed in other Sections of the Project Specifications.

B. Format: Prepare and assemble Operation and Maintenance Manuals in heavy-duty, 3-ring, hardback loose leaf binders in the form of an instructional manual. All binders for each discipline shall be the same color. When multiple binders are used, correlate data into related consistent groupings. Binder front shall containing permanently attached labels displaying the following:

1. Heading:
   The City of New York
   Department of Design and Construction
   Division of Public Buildings
2. Capital Budget Project Number (FMS ID)
3. Name and Location of Project
4. Contractor's name and Address
5. Subcontractor's Name and Address (where applicable)
6. Dates of the work covered by the contents of the Project Manual.
7. Binder spine shall display Project Number (FMS ID) and date of completion.

C. Organization: Include a section in the directory for each of the following:

1. List of documents
2. List of systems
3. List of equipment
4. Table of contents

D. Arrange content by systems under Specification Section numbers and sequence of Table of Contents of the Project manual. Provide tabbed flyleaf for each separate product, equipment and/or system/subsystem with typed description of product and major component parts of equipment.

E. Safety warnings or cautions shall be visibly highlighted within each maintenance procedure. Use of such highlights shall be limited to only critical items and shall not be used in an excessive manner which would reduce their effectiveness.

F. For each product or system, list names, addresses and telephone numbers of Subcontractors and Suppliers, including local source of supplies and replacement parts. Vendors and Supplier listings are to include names, addresses and telephone numbers, including nearest field service telephone numbers.

G. Where contents of the manual include any manufacturer's catalog pages, clearly indicate the precise items and options included in the installation and delete all manufacturers' data regarding products not included in the installation.

H. All material within manuals shall be new. Copies used for prior submittals or used in construction shall not be used.

I. Submit preliminary and final manual editions to the Commissioner according to the approved progress schedule.

J. Manuals shall present all technical material to the greatest extent possible, with respect to text, tabular matter and illustrations. Illustrations shall preferably consist of line drawings. All applicable drawings shall be included. If available, color photograph prints may be included.

K. Preliminary manual editions shall be as technically complete as the final manual edition. All illustrations shall be in final forms.

L. Final manual editions shall be technically accurate and complete and shall represent all "as-built" systems, pieces of equipment, or materials, which have been accepted by the Commissioner. All illustrations, text and tabular material shall be in final form. All shop drawings shall be included as specified in individual Specification Sections.

M. Building products, applied materials, and finishes: Include product data, with catalog number, size, composition, and color texture designations. Where applicable, provide information for re-ordering custom manufactured products.

N. Instructions for care and maintenance: Include manufacturers' recommendations for cleaning agents and methods, and recommended schedule for cleaning and maintenance.

O. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical compositions, and details of installation. Provide recommendations for inspections, maintenance, and repair.

P. Additional Requirements: Specified in individual Specification Sections.

2.6 DEMONSTRATION AND ORIENTATION DVD:

A. Non-Commissioned Projects: The Contractor shall submit final version of applicable Demonstration and Training DVD recordings in compliance with Section 01 79 00, DEMONSTRATION AND OWNER'S PRE-ACCEPTANCE ORIENTATION.

2.7 GUARANTEES AND WARRANTIES:

A. SCHEDULE B – Requirements for guarantees and warranties for the Project are set forth in Schedule B, which is included as part of the Addendum.

B. FORM – For all guarantee requirements set forth in Schedule B, the Contractor shall provide a written guaranty, in the form set forth herein.

C. Submit fully executed and signed manufacturers' Warranties as listed in the Project Specifications and outlined in Schedule B of the Addendum. Refer to Section 01 77 00, CLOSEOUT PROCEDURES for submittal requirements.

GUARANTY

DDC PROJECT # _____

PROJECT DESCRIPTION _____

_____

CONTRACT # _____

SPECIFICATION SECTION # AND TITLE _____

_____

GUARANTY TO BE IN EFFECT FROM _____

TO _____

The Contractor hereby guarantees that the work specified under the above section of the aforesaid Contract will be free from defects of material and/or workmanship, for the period indicated above.

The Contractor also guarantees that it will promptly repair, restore, rebuild or replace whichever may be deemed necessary by the City, any or all defective material or workmanship of the aforementioned section, that may appear within the guaranty period and any finished work to which damage may occur because of such defects, to the satisfaction of the City and without any cost or expense to the City.

The Contractor hereby agrees to pay to the City the cost of the repairs or replacements should the City make the same because of the failure of the Contractor to do so.

Contractor: _____

By: _____
Signature of Partner or Corporate Officer

Print Name: _____

Subscribed and sworn to before me this
day of _____ , year _____

_____
Notary Public

2.8 WASTE DISPOSAL DOCUMENTATION:

A. Certify and deliver to the Commissioner all documentation including reports, receipts, certificates, records etc. for the collection, handling, storage, classification, testing, transportation, recycling and/or disposal of all Non-Hazardous Construction Waste as required by Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL, and Hazardous Waste as required by other Project Specification Sections. Certify compliance with all applicable governing laws, codes, rules and regulations.

2.9 MISCELLANEOUS RECORD DOCUMENTS:

A. Refer to other Project Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Prior to Final Acceptance, complete miscellaneous records and place in good order, properly identified and bound or otherwise organized to allow for use and reference.

B. Submit three (3) copies of each document to the Commissioner or as otherwise directed by the Commissioner.

PART III – EXECUTION

3.1 RECORDING AND MAINTENANCE:

A. Recording: Maintain one copy of each submittal during the construction period for Contract Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Contract Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to the Contract Record Documents for the Resident Engineer's reference during normal working hours.

END OF SECTION 01 79 39

SECTION 01 79 00
DEMONSTRATION AND OWNER'S PRE-ACCEPTANCE ORIENTATION

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 79 00

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes administrative and procedural requirements, when set forth in sections of the Project Specifications, for instructing facility's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Owner's Pre-Acceptance Orientation in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and Orientation videotapes. (Non-Commissioned Projects)

B. The Contractor shall provide the services of equipment manufacturers orientation specialists experienced in the type of equipment to be demonstrated.

C. Separate Orientation sessions shall be conducted for mechanical operations and maintenance personnel and for electronic and electrical maintenance personnel.

D. Commissioning: Refer to the Addendum to identify whether this project is to be Commissioned. For Commissioned projects the Contractor shall provide Demonstration and Orientation as described in this section and cooperate with the Commissioning Authority/Agent (CxA) to implement Commissioning requirements as described in Section 01 91 13, GENERAL COMMISSIONING REQUIREMENTS.

1.3 RELATED SECTIONS: include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 33 00 SUBMITTAL PROCEDURES
C. Section 01 77 00 CLOSEOUT PROCEDURES
D. Section 01 78 39 CONTRACT RECORD DOCUMENTS
E. Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS
F. Specific requirements for demonstration and training indicated in other sections of the Project Specifications

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

1.5 SUBMITTALS:

A. Instruction Program: Submit three (3) copies of outline of instructional program for demonstration and orientation, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each orientation module to the Commissioner for approval no less than thirty (30) days prior to the date the proposed orientation is to take place. Include learning objectives and outline for each orientation module.

1. At completion of training, submit three (3) complete training manual(s) and three (3) applicable DVD recording(s) to the Commissioner for the facility's and City's use.

B. Qualification Data: For facilitator, instructor and Videographer.

C. Attendance Record: For each orientation module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each orientation module, submit results and documentation of performance-based test.

E. Submit all final orientation material to the Resident Engineer a minimum of fourteen (14) days prior to the scheduled training.

F. Demonstration and Orientation Recordings:

1. Non-Commissioned Projects:

a. The Contractor shall submit to the Commissioner three (3) copies of Demonstration and Orientation DVD (Digital Video Disk) recordings within seven (7) days of end of each training module.

b. Identification: On each copy, provide an applied label with the following information:

1) Project Contract I.D. Number
2) Project Contract Name
3) Name of Contractor
4) Name of Subcontractor as applicable
5) Name of Design Consultant
6) Name of Construction Manager as applicable
7) Date recorded.
8) Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
9) Table of Contents including list of systems covered.

c. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding DVD recording. Include name of Project and date of recording on each page.

2. Commissioned Projects:

a. Demonstration and Orientation DVD recordings for Commissioned projects will be recorded by the Commissioning Authority/Agent (CxA) under separate contract with the City of New

York. The Contractor performing Demonstration and Orientation shall cooperate with the CxA in the recording of each Demonstration and Orientation module.

1.6 QUALITY ASSURANCE:

A. Facilitator Qualifications: A firm or individual experienced in orientation or educating maintenance personnel in an orientation program similar in content and extent to that indicated for this Project.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00, QUALITY REQUIREMENTS, experienced in operation and maintenance procedures and orientation.

C. Videographer Qualifications: A professional Videographer who has experience with orientation and construction projects.

D. Pre-instruction Conference: Schedule with the Resident Engineer a conference at Project site to comply with requirements in Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION. Review methods and procedures related to demonstration and orientation including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.7 COORDINATION:

A. Coordinate instruction schedule with the Resident Engineer and facility's operations. Adjust schedule as required to minimize disrupting facility's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of orientation modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the Commissioner.

PART II – PRODUCTS

2.1 INSTRUCTION PROGRAM:

A. Program Structure: Develop an instruction program that includes individual orientation modules for each system and equipment not part of a system, as specified and required by individual Specification Sections.

B. Orientation Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.

d. Regulatory requirements.
e. Equipment function including auxiliary equipment and systems.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning

e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.
h. Housekeeping practices

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART III – EXECUTION

3.1 INSTRUCTION:

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and the Resident Engineer for the number of participants, instruction times, and location.

B. The Contractor shall engage qualified instructors to instruct facility's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Schedule instruction with the Resident Engineer at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule orientation with the Resident Engineer with at least fourteen (14) days' advance notice.

D. Evaluation: At conclusion of each orientation module, assess and document each participant's mastery of module(s) by use of an oral a written or a demonstration performance-based test.

E. Cleanup: Collect and remove used and leftover educational materials from project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial orientation use.

3.2 DEMONSTRATION AND ORIENTATION RECORDINGS:

A. Non-Commissioned projects:
1. The Contractor shall engage a qualified commercial Videographer to record demonstration and orientation sessions. Record each orientation module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
2. At beginning of each orientation module, record each chart containing learning objective and lesson outline.
3. All recordings must be close captioned.
4. Recording Format: Provide high-quality DVD (Digital Video Disk) format.
5. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and orientation. Display continuous running time.
6. Narration: Describe scenes on the recording by audio narration by microphone while recording or by dubbing audio narration off-site after. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

7. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from opposite the corresponding narration segment.

B. Commissioned Projects:

Refer to the Addendum to determine if the project is to be Commissioned.

1. The Commissioning Authority/Agent (CxA) under separate contract with the City of New York will assess and comment on the adequacy of the Orientation Instruction sessions by reviewing the Orientation and Instruction program and agenda provided by each contractor. The provider of the Orientation program will videotape the sessions and provide a copy to the CxA for final review and comments. If necessary, Contractor shall edit the DVD recording per CxA comnents.

END OF SECTION 01 79 00

SECTION 01 81 13
SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 81 13

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. LEED BUILDING - GENERAL REQUIREMENTS:

The City of New York is committed to implementing good environmental practices and procedures which include achieving a LEED™ Green Building rating. Specific project requirements related to this goal are listed in the applicable paragraphs of this section of the General Conditions. The Contractor shall ensure that these requirements as defined in the sections below and in related sections of the Contract Documents, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated LEED BUILDING criteria.

B. This Section includes:

1. Definitions
2. LEED Provisions
3. LEED Building Submittals
4. LEED Building Submittal Requirements
5. LEED Action Plan

1.3 RELATED SECTIONS: Include without limitation the following:

A.	Section 01 74 19	CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
B.	Section 01 81 13.13	VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS AND COATINGS
C.	Section 01 81 19	INDOOR AIR QUALITY REQUIREMENTS FOR LEED BUILDINGS
D.	Section 01 91 13	GENERAL COMMISSIONING REQUIREMENTS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Agrifiber Products: Products derived from recovered agricultural waste fiber from sources such as cereal straw, sugarcane bagasse, sunflower husk, walnut shells, coconut husks, and agricultural prunings, processed and mixed with resins to produce panels with characteristics similar to composite wood.

C. Composite Wood: Products composed of wood or plant particles or fibers bonded by a synthetic resin or binder to produce panels such as plywood, particleboard, and medium density fiberboard (MDF). Does not include hardboard, structural panels, glued laminated timber, prefabricated wood I-joists, or finger-jointed lumber.

D. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

E. Forest Stewardship Council (FSC) Certified Wood: Wood-based materials and products certified in accordance with the Forest Stewardship Council's principles and criteria.

F. LEED: The Leadership in Energy & Environmental Design rating system developed by the United States Green Building Council.

G. Rapidly Renewable Materials: Materials made from agricultural products that are typically harvested within a ten-year or shorter cycle. Rapidly renewable materials include products made from bamboo, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.

H. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

I. Regionally Extracted, Harvested, or Recovered Materials: Materials which are extracted, harvested, or recovered and manufactured within a radius of 500 miles from the Project site.

J. Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).
   1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.
   2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.
   3. "Pre-consumer" may also be referred to as "post-industrial".

K. Solar Reflectance Index (SRI): A measure of a material's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is equal to 0, and a standard white (reflectance 0.80, emittance of 0.90) is equal to 100.

L. Volatile Organic Compound (VOC): Any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) which vaporizes (becomes a gas) and participates in atmospheric photochemical reactions, as specified in Part 51.00 of Chapter 40 of the U.S. Code of Federal Regulations, at normal room temperatures. For the purposes of this specification, formaldehyde and acetaldehyde are considered to be VOCs.

1.5 LEED PROVISIONS:

A. Refer to the Addendum for the LEED rating to be achieved for this project. The provisions to achieve this LEED rating are integrated within the project construction documents and specifications. The Contractor is specifically directed to the "LEED BUILDING Performance Criteria" and "LEED BUILDING Submittals" sections within the contract specification. Additional LEED requirements are met through aspects of the project design, including material and equipment selections, which may not be specifically identified as LEED BUILDING requirements. Compliance with the requirements needed to obtain LEED prerequisites and credits will be used as one criterion to evaluate substitution requests.

1.6 LEED BUILDING SUBMITTALS:

A. Scope: LEED BUILDING submittals are required for all installed materials included in General Construction work. LEED BUILDING Submittals are only required for field-applied adhesives, sealants, paints and coatings included in Plumbing, Mechanical and Electrical work. Submit all required LEED BUILDING submittals in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

B. Applicability: The extent of the LEED BUILDING Submittals varies depending on the specification section. Applicable LEED BUILDING Submittals are listed under the "LEED BUILDING Submittals" heading in each specification section. The detailed requirements for the LEED BUILDING Submittals are defined in Item C below.

C. Detailed Requirements: Sub-Sections 1.6 C.1through 1.6 C.3 below defines the information and documents to be provided for each type of LEED BUILDING Submittal as identified in the LEED Submittal Requirements of each specification section:

1. ENVIRONMENTAL BUILDING MATERIALS CERTIFICATION FORM (EBMCF)[GHI]: Information to be supplied for this form (blank sample copy attached at end of this Section to be modified as appropriate to the project) shall include some or all of the following items, as identified in the LEED Submittal Requirements of each specification section:

   a. Cost breakdowns for the materials included in the contractor or sub-contractor's scope of work. Cost reporting shall include itemized material costs (excluding the contractor's labor, equipment, overhead and profit).
   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
      1. For each product with recycled content, also indicate the total recycled content value (1/2 x pre-consumer percentage x product value + 1 x post-consumer percentage x product value = total recycled content value).
      2. See additional requirements for concrete below.
   c. Identification (Yes/No) of materials manufactured within 500 miles of the project site AND containing raw materials harvested or extracted within 500 miles of the project site.
      1) Indicate the percentage by weight, relative to the total weight of the product that meets these criteria.
      2) Indicate the point of harvest/extraction/recovery of regional raw materials, the point of final assembly of regional manufactured products, and the distance from each point to the project site.
   d. Volatile Organic Compound (VOC) content of all field-applied adhesives, sealants, paints, and coatings, listed in grams/liter or lbs./gallon, less water.
      1) For detailed requirements refer to Section 01 81 13.13 VOC LIMITS FOR ADHESIVES, SEALANTS, PAINTS AND COATINGS.
   e. The amount of "Forest Stewardship Council (FSC) Certified" wood products if used in the Project.
      1) Record only new FSC-certified wood products. Do not record reclaimed, salvaged, or recycled FSC-certified wood products.

2) Reclaimed, salvaged, or recycled FSC-certified wood may be recorded as post-consumer recycled content.

f. The amount of Rapidly Renewable materials if used in the Project.
   1) Indicate the type of rapidly renewable material used, and the percentage by weight, relative to the total weight of the product, that consists of rapidly renewable material.

g. The percentage (by weight), relative to the total weight of cementitious materials, of supplementary cementitious materials or pozzolans such as fly ash used in each concrete mix used in the Project.
   1) For each concrete mix, provide a complete breakdown of all components, by weight and by cost.

h. Identification (Yes/No) of composite wood or agrifiber products used in the project that are free of added urea-added formaldehyde resins.

i. Identification (Yes/No) of flooring products used in the project that have Carpet and Rug Institute (CRI) Green Label or Green Label Plus certification, or Resilient Floor Covering Institute FloorScore certification.
   1) Untreated solid wood flooring, and mineral-based flooring products such as tile, masonry, terrazzo, and cut stone that have no organic-based coatings or sealants, are excluded from this requirement.

j. The EBMCF shall record the above information only for those materials or products permanently installed in the project. The EBMCF shall record VOC content, composite and agrifiber products, and CRI or FloorScore ratings only for those materials or products permanently installed within the weather barrier of the LEED building.

2. EBMCF BACK-UP DOCUMENTATION: These documents are used to validate the information provided on the EBMCF (except cost data). For each material listed on the EBMCF, provide documentation to certify the material's LEED BUILDING attributes, as applicable:

   a. RECYCLED CONTENT: Provide published product literature or letter of certification on the manufacturer's letterhead certifying the amounts of post-consumer and/or post-industrial content.

   b. REGIONAL MANUFACTURING **AND** REGIONAL RAW MATERIALS (WITHIN 500 MILES): Provide published product literature or letter of certification on the manufacturer's letterhead indicating the city/state where the manufacturing plant is located, where each of the raw materials in the product were extracted, harvested or recovered and the distance in miles from the project site.
      1) If only some of the raw materials for a particular product or assembly originate within 500 miles of the project site, provide the percentage (by weight) that these materials comprise in the complete product.

   c. VOC CONTENT: Provide Material Safety Data Sheets (MSDS) certifying the Volatile Organic Compound (VOC) content of the adhesive, sealant, paint, or coating products. VOC content is to be reported in grams/liter or lbs./gallon, less water. If the MSDS does not show the product's VOC content, this information must be provided through other published product literature from the manufacturer, or stated in a letter of certification from the product manufacturer on the manufacturer's letterhead.

   d. RAPIDLY RENEWABLE MATERIALS: If used in the project, provide published literature or letter of certification on the manufacturer's letterhead certifying the percentage of each product that is rapidly renewable (by weight).

3. PRODUCT CUT SHEETS: Provide product cut sheets with the Contractor's or sub-contractor's stamp, confirming that the submitted products are the products installed in the Project.

4. CRI GREEN LABEL PLUS CERTIFICATION: For carpets and carpet cushions, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products comply with the "Green Label Plus" IAQ testing program of the Carpet and Rug Institute of Dalton, GA.

5. CERTIFICATION OF COMPOSITE WOOD OR AGRIFIBER RESINS: For all composite wood, engineered wood and agrifiber products (including plywood, particleboard, and medium density fiberboard), provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that that the products do not contain added urea-formaldehyde resins.

6. CERTIFICATION OF COMPOSITE WOOD OR AGRIFIBER LAMINATING ADHESIVES: For all laminating adhesives used with composite wood, engineered wood and agrifiber products (e.g., adhesives used to laminate wood veneers to an engineered wood substrate), provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the adhesive products do not contain urea-formaldehyde.

7. FSC-CERTIFIED WOOD:
   a. If used in the project, provide chain of custody documents and copies of invoices regarding wood products, including whether or not such wood product is FSC-certified.
   b. If used in the project, for assemblies, provide the percentage (by cost and by weight) of the assembly that is FSC-certified wood.
   c. If used in the project, for assemblies, provide published product literature or letter from the manufacturer(on the manufacturer's letterhead) verifying the percentage that is FSC-certified wood.

8. GREEN SEAL COMPLIANCE: Provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the following product types comply with the VOC limits and chemical component restrictions developed by the Green Seal organization of Washington, DC:
   a. Interior Architectural Paints and Coatings: refer to Green Seal standard GS-11 (1st edition, May 1993)
   b. Anti-corrosive and Anti-rust paints: refer to Green Seal standard GC-03 (2nd Edition, January 1997)
   c. Aerosol Adhesives: refer to Green Seal standard GS-36 (1st edition, October 2000)

9. HIGH ALBEDO PAVING AND WALKWAY MATERIALS: For paving and walkway materials made from concrete or brick provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying a minimum Solar Reflectance Index (SRI) value of 29. SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.

10. HIGH ALBEDO ROOFING MATERIALS: For exposed roofing membranes, pavers, and ballast products, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying the following minimum Solar Reflectance Index (SRI) values:
    a. 78 for low-sloped roofing applications (slope ≤ 2:12)
    b. 29 for steep-sloped roofing applications (slope > 2:12)

    SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.
    Vegetated roof surfaces are exempt from the SRI criteria.

11. LOW MERCURY LAMPS: For all fluorescent, compact fluorescent, and HID lamps installed in the project, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying:
    a. The mercury content or content range per lamp in milligrams or picograms;
    b. The design light output per lamp (light at 40% of a lamp's useful life) in lumens; and
    c. The rated average life of the lamp in hours.

In addition, provide the total number of each lamp type installed in the project.

12. FLOORSCORE CERTIFICATION: For all hard surface flooring, including vinyl, linoleum, laminate flooring, wood flooring, ceramic flooring, rubber flooring, and wall base, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products comply with the current FloorScore standard requirements.

13. CONCRETE: Provide concrete mix design for each mix, designated by a distinct identifying code or number and signed by a Professional Engineer licensed in the state in which the concrete manufacturer or supplier is located.

14. INTERIOR LIGHTING FIXTURES: For each lighting fixture type installed within the building's weather barrier, provide manufacturer's cut sheets indicating the following:

    a. Fixture power in watts.
    b. Initial lamp lumens.
    c. Photometric distribution data.
    d. Dimming capability, in range of percentages.

15. EXTERIOR LIGHTING FIXTURES: For each lighting fixture type installed on site, provide manufacturer's cut sheets indicating the following:

    a. Fixture power in watts.
    b. Initial lamp lumens.
    c. Photometric distribution data.
    d. Range of field adjustability, if any.
    e. Warranty of suitability for exterior use.

16. ALTERNATIVE TRANSPORTATION: Provide manufacturer's cut sheets and/or shop drawings for the following items installed on site:

    a. Bike racks, including total number of bicycle slots provided.
    b. Signage indicating parking spaces reserved for electric or low-emitting vehicles and for carpools/vanpools, including total number of signs.

17. WATER CONSERVING FIXTURES: For all water consuming plumbing fixtures and fittings, provide manufacturer's cut sheets showing maximum flow rates and/or flush rates.

18. ENERGY SAVING APPLIANCES: Provide manufacturer's cut sheets and published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying the product's rating under the U.S. EPA/DOE Energy Star program, for all of the following:

    a. Appliances (i.e., refrigerators, dishwashers, microwave ovens, televisions, clothes washers, clothes dryers, chilled water dispensers).
    b. Office equipment (i.e., copy machines, fax machines, plotters/printers, scanners, binding and publishing equipment).
    c. Electronics (i.e., servers, desktop computers, computer monitor displays, laptop computers, network equipment).
    d. Commercial food service equipment

19. GLAZING: For glazing in any windows, doors, storefront and window wall systems, curtainwall systems, skylights, and partitions, provide manufacturer's cut sheets indicating the following:

    a. Glazed area.
    b. Visible light transmittance.
    c. Solar heat gain coefficient.
    d. Fenestration assembly u-factor.

20. VENTILATION: Provide manufacturer's cut sheets for the following:
    a. Carbon dioxide monitoring systems, if any, installed to measure outside air delivery.
    b. Air filters: for detailed requirements refer to Section 01 81 19 INDOOR AIR QUALITY REQUIREMENTS.
21. REFRIGERATION: For all refrigeration equipment, provide manufacturer's cut sheets indicating the following:
    a. Equipment type.
    b. Equipment life. Default values specified by the 2007 ASHRAE Applications Handbook will be used unless otherwise demonstrated by the manufacturer's guarantee and an equivalent long-term service contract.
    c. Refrigerant type.
    d. Refrigerant charge in pounds of refrigerant per ton of gross cooling capacity.
    e. Tested refrigerant leakage rate, in percent per year. A default rate of 2% will be used unless otherwise demonstrated by test data.
    f. Tested end-of-life refrigerant loss, in percent. A default rate of 10% will be used unless otherwise demonstrated by test data.

1.7 LEED BUILDING SUBMITTAL REQUIREMENTS:

A. The LEED BUILDING Submittal information shall be assembled into one package per contract specification section(s) (or per subcontractor), and submitted in accordance with Section 01 33 00, SUBMITTAL PROCEDURES. Incomplete or inaccurate LEED BUILDING submittals may be used as the basis for the rejection of products or assemblies. Incomplete or inaccurate LEED BUILDING Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.8 LEED ACTION PLANS:

A. Construction Waste Management Plan- Refer to Section 01 74 19, Construction Waste Management and Disposal for detailed submittal requirements.

B. Construction IAQ Management Plan- Refer to Section 01 81 19, Indoor Air Quality Requirements for LEED Buildings, for detailed submittal requirements.

C. Erosion and Sedimentation Control Plan:
    1. The Plan shall be in accordance with the New York State Department of Environmental Conservation (NYSDEC) or the 2003 EPA Construction General Permit, whichever is more stringent.
    2. The Plan shall be submitted in accordance with Section 01 33 00, SUBMITTAL PROCEEDURES.
    3. Detailed requirements: ESC Plan
        a. Include the Stormwater Pollution Prevention Plan, if required.
        b. Identify the party responsible for Plan monitoring and documentation. The party must be regularly on site.
        c. Describe all site work that will be implemented on the project.
        d. Provide site plan with location of ESC measures, including, but not limited to, stormwater quantity controls, stormwater quality controls, stabilized construction entrances, washdown areas, and inlet/catch basin protection.
        e. Describe the inspection and maintenance of the ESC measures. Provide a construction schedule indicating weekly site review.
        f. Describe reporting and documentation measures.
    4. Detailed requirements: ESC Measures

5. Submittal requirements: ESC Tracking Log
   a. Note date of major rain events, describe damage, describe any repairs or maintenance performed, and note responsible party.
   b. Note date and findings of weekly site review, describe any repairs or maintenance performed, and note responsible party.
   c. Submit monthly.
6. Implementation
   a. The Contractor shall implement the ESC Plan, coordinate the Plan with all affected trades, and designate one individual as the Erosion and Sedimentation Control Representative, who will be responsible for communicating the progress of the Plan with the Commissioner on a regular basis, and for assembling the required LEED documentation.
   b. The Contractor shall be responsible for the provision, maintenance, and repair of all ESC measures.
   c. Demonstration. The Contractor shall provide on-site instruction of proper construction practices required to prevent erosion and sedimentation.
   d. Meetings. Urgent or ongoing ESC issues shall be discussed at weekly on-site job meetings.

1.9 QUALITY ASSURANCE:

A. The Contractor shall implement all LEED Action Plans, coordinate the Plans and LEED Building Submittals with all affected trades, and designate one individual as the Sustainable Construction Representative at no additional cost to the City of New York, who will be responsible for communicating the progress of LEED activities with the Commissioner on a regular basis, and for assembling the required LEED documentation.

B. Responsibilities of Contractor's Subcontractors: The Contractor shall be responsible for his/her subcontractors complying with the LEED Action Plans and for providing required LEED documentation as required for the project.

C. Distribution and Compilation: The Contractor shall be responsible for distributing the EBMCF and any other forms or templates required for the subcontractors to record LEED documentation. The Contractor shall also be responsible for collecting and compiling EBMCF information into packages as described in Section 01 33 00 SUBMITTAL PROCEDURES.

D. Meetings: Sustainable design and construction issues shall be discussed at the following meetings:
   1. Demolition kick-off meeting
   2. Construction kick-off meeting
   3. Construction kick-off meeting for LEED (independent meeting)
   4. Weekly job-site progress and coordination meetings
   5. Closeout meeting

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 81 13

NEW YORK CITY DEPARTMENT OF DESIGN + CONSTRUCTION

ENVIRONMENTAL BUILDING MATERIALS CERTIFICATION FORM

Contractor Name: _____
Contractor Contact: _____
Telephone Number: _____

Project Name: _____
Project I.D.: _____

Product/Manufacturer	Material Cost[1]	Recycled Content			Regional[4]			Rapidly Renewable[7]		VOC content[8]		Flooring[9]	Wood	
		Pre-Consumer (% by wt)[2]	Post-Consumer (% by wt)[3]	Total % (½ Pre + Post)	Location & Distance to Extraction[5]	Location & Distance to Manufacture[6]	Extracted & Manuf. (% by wt)	Material	% by wt	*VOC content listed	*VOC content allowed	*Green Label or FloorScore	*Added urea formaldehyde (Yes/No)[10]	FSC Certified[11] (% by wt)

[1] **Material Cost:** As it appears on the manufacturer's or distributor's invoice to the contractor or subcontractor. Does not include labor or equipment costs associated with installation.

[2] **Pre-Consumer Recycled Content:** Industrial/manufacturing waste material (e.g., fly-ash and synthetic gypsum, both waste products from coal burning electricity plants) diverted from landfill and incorporated into a finished product. Scrap raw materials that can be reused in the same manufacturing process from which they are recovered are not considered Pre-Consumer Recycled Content.

[3] **Post-Consumer Recycled Content:** Material or product that has served its intended consumer use (e.g., an empty plastic bottle) and has been diverted from landfill and incorporated into a finished product.

[4] **Regional:** Refers to a material/product that is BOTH extracted AND manufactured within 500 miles of the Project site. Record this information ONLY for materials/products meeting BOTH of these criteria.

[5] **Extraction:** Refers to the location from which the raw resources used in a building product are extracted, harvested, or recovered.

[6] **Manufacture:** Refers to the location of the final assembly of components into a building product that is furnished and installed by the Contractor.

[7] **Rapidly Renewable:** Refers to materials/products derived from agricultural products that are typically harvested within a ten-year or shorter cycle.

[8] **VOC Content:** The quantity of volatile organic compounds contained in adhesives, sealants. paints and architectural coatings. Reported in grams/liter or lbs/gallon, less water.

[9] **Flooring:** For carpet, indicate Carpet and Rug Institute (CRI) Green Label Plus certification. For carpet cushion, indicate CRI Green Label certification. For all flooring except unfinished/untreated wood and mineral-based flooring (tile, masonry, terrazzo, cut stone) without organic-based coatings or sealants, indicate Resilient Floor Covering Institute FloorScore rating. VOC limits for adhesives, sealants, etc. still apply.

[10] **Added Urea Formaldehyde:** Applies to composite wood and agrifiber products only (plywood, particleboard, MDF, OSB, wheatboard, strawboard). Resins or binders with added urea formaldehyde are prohibited.

[11] **FSC Certified:** Certification from the Forest Stewardship Council. This column is only applicable to wood products.

* Applies only to materials/products installed within the weather barrier.

Contractor Certification:

I, _____ a duly authorized representative of _____ (the Contractor) hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by the Contractor as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the Commissioner.

Signature of Authorized Representative: _____ Date: _____

SECTION 01 81 13.13
VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS AND COATINGS FOR LEED BUILDINGS

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 81 13.13

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY:

A. This Section includes requirements for volatile organic compound (VOC) content in adhesives, sealants, paints and coatings used for the project.

B. All sections in the Project Specifications with adhesives, sealant or sealant primer applications, paints and coatings shall follow all requirements of this section. In the event of any conflict or inconsistency between this section and the Specifications regarding adhesives, sealant or sealant applications, paints and coatings, the requirements set forth in this Section shall prevail.

C. This Section includes:

1. General Requirements
2. References
3. VOC Requirements for Interior Adhesives
4. VOC Requirements for Interior Sealants
5. VOC requirements for Interior Paints
6. VOC requirements for Interior Coatings
7. Submittals

1.3 RELATED SECTIONS: Include without limitation the following:

A. Section 01 10 00 SUMMARY
B. Section 01 31 00 PROJECT MANAGEMENT AND COORDINATION
C. Section 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION
D. Section 01 33 00 SUBMITTAL PROCEDURES
E. Section 01 73 00 EXECUTION
F. Section 01 77 00 CLOSEOUT PROCEDURES
G. Section 01 78 39 CONTRACT RECORD DOCUMENTS
H. Section 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS
I. Section 01 81 19 INDOOR AIR QUALITY FOR LEED BUILDINGS

1.4 DEFINITIONS:

A. ADHESIVE: Any substance used to bond one surface to another by attachment. Includes adhesive primers and adhesive bonding primers.
   1. Aerosol Adhesive: Any adhesive packaged as an aerosol with a spray mechanism permanently housed in a non-refillable can designed for hand-held application without the need for ancillary equipment.

B. CARCINOGEN: A chemical listed as a known, probable, reasonably anticipated, or possible human

carcinogen by the International Agency for Research on Cancer (IARC) (Groups 1, 2A, and 2B), the National Toxicology Program (NTP) (Groups 1 and 2), the U.S. Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS) (weight-of-evidence classifications A, B1, B2, and C, carcinogenic, likely to be carcinogenic, and suggestive evidence of carcinogenicity or carcinogen potential), or the Occupational Safety and Health Administration (OSHA).

C. CLEAR WOOD FINISH: Clear/semi-transparent coating applied to wood substrates to provide a transparent or translucent solid film.
   1. Lacquer: Clear/semi-transparent coating formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction and provide a solid, protective film.
   2. Sanding Sealer: A sanding sealer that also meets the definition of a lacquer.
   3. Varnish: Clear/semi-transparent coating, excluding lacquers and shellacs, formulated to dry by chemical reaction on exposure to air. May contain small amounts of pigment.

D. COATING: Liquid, liquefiable, or mastic composition that is converted to a solid adherent film after application to a substrate as a thin layer; and is used for decorating, protecting, identifying or to serve some functional purpose such as the filling or concealing of surface irregularities or the modification of light and heat radiation characteristics; and is intended for on-site application to interior or exterior surfaces of buildings. Does not include stains, clear finishes, recycled latex paint, specialty (industrial, marine or automotive) coatings or paint sold in aerosol cans.

E. FLOOR COATING: Opaque coating applied to flooring. Excludes industrial maintenance coatings.

F. HAZARDOUS AIR POLLUTANT: Any compound listed by the U.S. EPA in the Clean Air Act Section 112(b)(1) as a hazardous air pollutant.

G. MUTAGEN: A chemical that meets the criteria for category 1, chemicals known to induce heritable mutations or to be regarding as if they induce heritable mutations in the germ cells of humans, under the Harmonized System for the Classification of Chemicals Which Cause Mutations in Germ Cells (United Nations Economic Commission for Europe, Globally Harmonized System of Classification and Labeling of Chemicals).

H. OZONE-DEPLETING COMPOUNDS: A compound with an ozone-depletion potential greater than 0.1 (CFC 11=1) according to the U.S. EPA list of Class I and Class II Ozone-Depleting Substances.

I. PAINT: A pigmented coating. For the purposes of this specification, paint primers are considered to be paints.
   1. Flat Coating or Paint: Has a gloss of less than 15 (using an 85-degree meter) or less than 5 (using a 60-degree meter).
   2. Non-Flat Coating or Paint: Has a gloss of greater than or equal to 15 (using an 85-degree meter) or greater than or equal to 5 (using a 60-degree meter).
   3. Non-Flat High-Gloss Coating or Paint: Has a gloss of greater than or equal to 70 (using a 60-degree meter).
   4. Anti-Corrosive / Rust Preventative Paint: Coating formulated and recommended for use in preventing the corrosion of ferrous metal substrates.

J. PRIMER: Coating that is formulated and recommended for one or more of the following purposes: to provide a firm bond between the substrate and a subsequent coating; to prevent a subsequent coating from being absorbed into the substrate; to prevent harm to a subsequent coating from materials in the substrate; or to provide a smooth surface for application of a subsequent coating.

K. REPRODUCTIVE TOXIN: A chemical listed as a reproductive toxin (including developmental, female, and male toxins) by the State of California under the Safe Drinking Water and Toxic Enforcement Act of 1986 (California Code of Regulations, Title 22, Division 2, Subdivision 1, Chapter 3, Sections 1200, et. Seq.).

L. SANDING SEALER: Clear/semi-transparent coating formulated to seal bare wood. Can be abraded to create a smooth surface for subsequent coatings. Does not include sanding sealers that are lacquers (see Clear Wood Finish above).

M. SEALANT: Any material with adhesive properties, formulated primarily to fill, seal, or waterproof gaps or joints

between surfaces. Includes sealant primers and caulks.

N. SHELLAC: Clear or pigmented coating formulated solely with the resinous secretions of the lac beetle, thinned with alcohol and formulated to dry by evaporation without chemical reaction. Excludes floor applications.

O. STAIN: Clear semi-transparent/opaque coating formulated to change the color but not conceal the grain pattern or texture of the substrate.

P. VOLATILE AROMATIC COMPOUND: Any hydrocarbon compound containing one or more 6-carbone benzene rings, and having an initial boiling point less than or equal to 280 degrees Celsius measured at standard conditions of temperature and pressure.

Q. VOLATILE ORGANIC COMPOUND: Any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) which vaporizes (becomes a gas) and participates in atmospheric photochemical reactions, as specified in Part 51.00 of Chapter 40 of the U.S. Code of Federal Regulations, at normal room temperatures. For the purposes of this specification, formaldehyde and acetaldehyde are considered to be VOCs.

R. WATERPROOFING SEALER: A coating that prevents the penetration of water into porous substrates.

1.5 GENERAL REQUIREMENTS:

A. The City of New York is committed to implementing good environmental practices and procedures which include achieving a LEED Green building rating. Specific project requirements related to this goal which may impact this area of work are listed in the applicable paragraphs of this specification section. The Contractor shall ensure that the requirements as defined in the sections below and in related sections of the Contract Documents, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated environmental goals.

1.6 REFERENCES:

A. Rule 1168 – "Adhesive and Sealant Applications", amended 7 January 2005): South Coast Air Quality Management District (SCAQMD), State of California, www.aqmd.gov

B. Rule 1113 - "Architectural Coatings", amended 9 July 2004: South Coast Air Quality Management District (SCAQMD), State of California, www.aqmd.gov

C. Green Seal Standard GS-11- "Paints", of Green Seal, Inc., Washington, DC, www.greenseal.org

D. Green Seal Standard GC-03- "Anti-Corrosive Paints", of Green Seal, Inc., Washington, DC, www.greenseal.org

1.6 VOC REQUIREMENTS FOR INTERIOR ADHESIVES, SEALANTS, PAINTS AND COATINGS:

A. GENERAL: Unless otherwise specified herein, the VOC content of all interior adhesives, sealants, paints and coatings (herein referred to as "products") shall not be in excess of **250 grams per liter.**

B. No product shall contain any ingredients that are carcinogens, mutagens, reproductive toxins, persistent bioacculmulative compounds, hazardous air pollutants, or ozone-depleting compounds. An exception shall be made for titanium dioxide and, for products that are pre-tinted by the manufacturer, carbon black, which shall be less than or equal to 1% by weight of the product.

C. No product shall contain the following:
   1. methylene chloride
   2. 1,1,1-trichloroethane
   3. benzene

4. toluene
5. ethylbenzene
6. vinyl chloride
7. naphthalene
8. 1,2-dichlorobenzene
9. di (2-ethylhexyl) phthalate
10. butyl benzyl phthalate
11. di-n-butyl phthalate
12. di-n-octyl phthalate
13. diethyl phthalate
14. dimethyl phthalate
15. isophorone
16. antimony
17. cadmium
18. hexavalent chromium
19. lead
20. mercury
21. formaldehyde
22. methyl ethyl ketone
23. methyl isobutyl ketone
24. acrolein
25. acrylonitrile

D. No product shall contain more than 1.0% by weight of sum total of volatile aromatic compounds.

1.8 VOC REQUIREMENTS FOR INTERIOR ADHESIVES:

A. The volatile organic compound (VOC) content of adhesives, adhesive bonding primers, or adhesive primers used in this project shall not exceed the limits defined in Rule 1168 – "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California.

B. The VOC limits defined by SCAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.

C. For specified building construction related applications, the allowable VOC content is as follows:

1. Architectural Applications:

a.	Indoor carpet adhesive	50
b.	Carpet pad adhesive	50
c.	Wood flooring adhesive	100
d.	Rubber floor adhesive	60
e.	Subfloor adhesive	50
f.	Ceramic tile adhesive	65
g.	VCT and asphalt tile adhesive	50
h.	Drywall and panel adhesive	50
i.	Cove base adhesive	50
j.	Multipurpose construction adhesive	70
k.	Structural glazing adhesive	100

2. Specialty Applications:

a.	PVC welding	510
b.	CPVC welding	490
c.	ABS welding	325
d.	Plastic cement welding	250

e.	Adhesive primer for plastic	550
f.	Contact Adhesive	80
g.	Special Purpose Contact Adhesive	250
h.	Structural Wood Member Adhesive	140
i.	Sheet Applied Rubber Lining Operations	850
j.	Top and Trim Adhesive	250

3. Substrate Specific Applications:

a.	Metal to metal	30
b.	Plastic foams	50
c.	Porous material (except wood)	50
d.	Wood	30
e.	Fiberglass	80

4. Aerosol Adhesives:

a.	General purpose mist spray	65% VOC's by weight
b.	General purpose web spray	55% VOC's by weight
c.	Special purpose aerosol adhesives (all types)	70% VOC's by weight

1.9 VOC REQUIREMENTS FOR INTERIOR SEALANTS:

A. The volatile organic compound (VOC) content of sealants, or sealant primers used in this project shall not exceed the limits defined in Rule 1168 – "Adhesive and Sealant Applications" of the South Coast Air Quality Management District (SCAQMD), of the State of California.

B. The VOC limits defined by SCAQMD are as follows. All VOC limits are defined in grams per liter, less water and less exempt compounds.

1. Sealants:

a.	Architectural	250
b.	Non-membrane roof	300
c.	Roadway	250
d.	Single-ply roof membrane	450
e.	Other	420

2. Sealant Primer:

a.	Architectural – Nonporous	250
b.	Architectural – Porous	775
c.	Other	750

1.10 VOC REQUIREMENTS FOR INTERIOR PAINTS:

A. Paints and Primers: Paints and primers used in non-specialized interior applications (i.e., for wallboard, plaster, wood, metal doors and frames, etc.) shall meet the VOC limitations of the Green Seal Paint Standard GS-11, of Green Seal, Inc., Washington, DC. Product-specific environmental requirements are as follows:

5. Volatile Organic Compounds:
   a. The VOC concentrations (in grams per liter) of the product shall not exceed those listed below as determined by U. S. Environmental Protection Agency (EPA) Reference Test Method 24.

   Interior Paints and Primers:
   Non-flat: 150 g/l
   Flat: 50 g/l
   The calculation of VOC shall exclude water and tinting color added at the point of sale.

B. Anti- Corrosive and Anti-Rust Paints: Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates shall meet the VOC limitations of the Green Seal Paint Standard GC-03, of Green Seal, Inc., Washington, DC. Product-specific environmental requirements are as follows:

1. Volatile Organic Compounds:

   a. The VOC concentrations (in grams per liter) of the product shall not exceed those listed below as determined by U. S. Environmental Protection Agency (EPA) Reference Test Method 24.
   Anti-Corrosive and Anti-Rust Paints: 250 g/l

The calculation of VOC shall exclude water and tinting color added at the point of sale.

1.11 VOC REQUIREMENTS FOR INTERIOR COATINGS:

A. Clear wood finishes, floor coatings, stains, sealers, and shellacs applied to the interior shall meet the VOC limitations defined in Rule 1113, "Architectural Coatings" of SCAQMD, of the State of California. The VOC limits defined by SCAQMD, based on 7/9/04 amendments, are as follows. VOC limits are defined in grams per liter, less water and less exempt compounds.

1. Clear Wood Finishes:		
	a. Varnish	350
	b. Sanding Sealers	350
	c. Lacquer	550
2. Shellac:		
	a. Clear	730
	b. Pigmented	550
3. Stains		250
4. Floor Coatings		100
5. Waterproofing Sealers		250
6. Sanding Sealers		275
7. Other Sealers		200

The calculation of VOC shall exclude water and tinting color added at the point of sale.

1.12 SUBMITTALS:

A. Submit Material Safety Data Sheets, for all applicable products in accordance with Section 01 33 00, SUBMITTAL PROCEDURES. Applicable products include, but are not limited to adhesives, sealants, carpets, paints and coatings. Material Safety Data Sheets shall indicate the Volatile Organic Compound (VOC) limits of products submitted. (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).

B. Submit Environmental Building Materials Certification Form (EBMCF) as referenced in Section 01 81 13 SUSTAINABLE REQUIREMENTS FOR LEED BUILDINGS: For each field-applied adhesive, sealant, paint, and coating product, provide the VOC requirement, as provided in this Specification, for the relevant material category indicated on the documentation noted above.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 81 13.13

SECTION 01 81 19
INDOOR AIR QUALITY REQUIREMENTS FOR LEED BUILDINGS

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 81 19

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

1.2 CONSTRUCTION IAQ MANAGEMENT GOALS FOR THE PROJECT:

A. The City of New York has determined that this Project shall minimize the detrimental impacts on Indoor Air Quality (IAQ) resulting from construction activities. Factors that contaminate indoor air, such as dust entering HVAC systems and ductwork, improper storage of materials on-site, poor housekeeping, shall be minimized.

1.3 RELATED SECTIONS:

A. All sections of the Specifications related to interior construction, MEP systems, and items affecting indoor air quality.

B. Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS

C. Section 01 81 13.13, VOLATILE ORGANIC COMPOUND (VOC) LIMITS FOR ADHESIVES, SEALANTS, PAINTS AND COATINGS.

D. Division 9 (of the Specifications): Finishes.

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products, including solvents in paints, coatings, adhesives and sealants, wood preservatives, composite wood binder, and foam insulations. Not all VOC's are harmful, but many of those contained within building products contribute to the formation of smog and may irritate building occupants by their smell and/or health impact.

D. Materials that act as "sinks" for VOC contamination: Absorptive materials, typically dry and soft materials (such as textiles, carpeting, acoustical ceiling tiles and gypsum board) that readily absorb VOC's emitted by "source" materials and release them over a prolonged period of time.

E. Materials that act as "sources" for VOC contamination: Products with high VOC contents that emit VOC's either rapidly during application and curing (typically "wet" products, such as paints, sealants, adhesives, caulks and sealers) or over a prolonged period (typically "dry" products such as flooring coverings with plasticizers and engineered wood with formaldehyde).

1.5 REFERENCES, RESOURCES:

A. "IAQ Guidelines for Occupied Buildings Under Construction", First Edition, November 1995, The Sheet Metal and Air Conditioner Contractors National Association (SMACNA). (703) 803-2980, www.smacna.org.

B. ANSI/ASHRAE 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size", www.ashrae.org

1.6 LEED BUILDING GENERAL REQUIREMENTS:

A. Implement practices and procedures as necessary to meet the project's environmental performance goals as set forth in the specific requirements of this section. Specific project goals that may impact this area of work include: use of recycled-content materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor air quality management plan. Ensure that the requirements related to these goals, as defined in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be allowed if such changes compromise the stated LEED BUILDING Performance Criteria.

1.7 CONSTRUCTION IAQ MANAGEMENT PLAN :

A. The Contractor shall prepare a Construction IAQ Management Plan in coordination with each subcontractor and submit the IAQ Management Plan to the Commissioner for approval in accordance with Section 01 33 00, SUBMITTAL PROCDEURES. The Construction IAQ Management Plan shall meet the following criteria:

1. Construction activities shall be planned to meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) "IAQ Guidelines for Occupied Buildings under Construction", First Edition, 1995.
2. Absorptive materials shall be protected from moisture damage when stored on-site and after installation.
3. If air handlers are to be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999.
4. Filtration media shall be replaced immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999 if the project is pursuing Indoor Air Quality Credit 5: Indoor Chemical Pollutant Source Control.
5. A "Sequence of Finish Installation Plan" shall be developed, highlighting measures to reduce the absorption of VOCs by materials that act as "sinks".
6. Upon approval of the Plan by the Commissioner, it shall be implemented by the Contractor through the duration of the construction process, and documented in accordance with the Submittal Requirements of Sub-Section 1.8 herein.

B. Further description of the Construction IAQ Management Plan requirements is as follows:

1. SMACNA Guidelines: Chapter 3 of the referenced "IAQ Guidelines for Occupied Buildings Under Construction", outline IAQ measures in five categories as listed below. The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format, and shall address measures to be implemented in each of the five categories (including subsections). All subsections shall be listed in the Plan; items that are not applicable for this project should be listed as such.
   a. HVAC Protection
      1) Protect air handling and distribution equipment and air supply and return ducting during construction.
      2) All ductwork arriving on site will be sealed with plastic sheeting and stored on pallets or dunnage until installed.
      3) Cover and protect all exposed air inlets and outlets, openings, grilles, ducts, plenums, etc. to prevent water, moisture, dust and other contaminant intrusion.
      4) Apply protection immediately after ducting.
      5) Protect ducting runs at the end of day's work.
      6) Inspect temporary filtration weekly and replace as required to maintain the proper ventilation rates in the building.
   b. Source Control
      1) Protect stored on-site or installed absorptive or porous materials.
      2) Do not use wet or damaged porous materials in the building.
      3) Recover, isolate, and ventilate containers housing toxic materials and materials with VOC levels above the limits for interior adhesives, sealants, paints, and coatings described in these Specifications.
      4) Exhaust fumes from idling vehicles and gasoline fueled tools through use of funnels or temporary piping.
      5) Containers housing toxic materials and materials with VOC levels above the limits for interior adhesives, sealants, paints, and coatings described in these Specifications, shall be closed when not in use.
   c. Pathway Interruption
      1) Depressurize work areas to contain dust and odors.
      2) Pressurize occupied spaces to prevent intrusion of dust and odors.
      3) Erect barriers to contain construction areas.
      4) Relocate pollutant sources.
      5) Temporarily seal the building and provide 100% outside air for ventilation.
   d. Housekeeping
      1) Store materials on elevated platforms under cover, in a designated dry, clean location, prior to unpacking for installation.
      2) If materials are not stored in an enclosed location, cover tops and sides of material with waterproof sheeting, securely tied.
      3) Institute cleaning activities to remove contaminants from the building prior to occupancy. Clean all coils, air filters, and ductwork prior to performing testing, adjusting, and balancing of HVAC systems.
      4) Sweep the work area on a daily basis. Use an efficient and effective dust collecting method such as damp cloth, wet mop, or vacuum with particulate filters. Activities which produce high levels of dust shall be cleaned up immediately upon completion.
      5) Spills or excess applications of products containing solvents, or with VOC levels above the limits for interior adhesives, sealants, paints, and coatings described in these Specifications, must be removed immediately.
      6) Dust all walls prior to application of finishes.
      7) Vacuum all stud tracks prior to application of insulation.
      8) Materials which become contaminated through direct exposure to moisture from

precipitation, plumbing leaks, or condensation shall be replaced by the Contractor.

e. Scheduling
   1) Phase construction such that absorptive materials are installed only in areas that are weathertight.
   2) Schedule activities that utilize "sources" of VOC contamination to take place prior to installing high absorbent materials that will act as "sinks" for contaminants.
   3) Review of the appropriate components of the Construction IAQ Management Plan shall be a regular action topic at weekly site coordination meetings. Implementation of the Plan shall be documented in the meeting minutes.

2. Protection of Materials from Moisture Damage: As part of the "Housekeeping" section of the Construction IAQ Management Plan, measures to prevent installed materials or material stored on-site from moisture damage shall be described. This section should also describe measures to be taken if moisture damage does occur to absorptive materials during the course of construction.

3. Replacement of Filtration Media: Under the "HVAC Protection" section of the Construction IAQ Management Plan, a description of the filtration media in all ventilation equipment shall be provided. The description shall include replacement criteria for filtration media during construction, and confirmation of filtration media replacement for all equipment immediately prior to occupancy.

4. Sequence of Finish Installation for Materials: Where feasible, absorptive materials shall be installed after the installation of materials or finishes which have high short-term emissions of VOC's, formaldehyde, particulates, or other air-borne compounds. Absorptive materials include, but are not limited to: carpets; acoustical ceiling panels; fabric wall coverings; insulations (exposed to the airstream); upholstered furnishings; and other woven, fibrous or porous materials. Materials with high short-term emissions include, but are not limited to: adhesives, sealants and glazing compounds (specifically those with petrochemical vehicles or carriers); paints, wood preservatives and finishes; control and/or expansion joint fillers; hard finishes requiring adhesive installation; gypsum board (with associated finish processes and products); and composite or engineered wood products with formaldehyde binders.

5. Develop and implement an Indoor Air Quality (IAQ) Management Plan for the pre-occupancy phase as follows:

   <u>OPTION 1 — Flush-Out</u>

   • After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

   OR

   • If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cu.ft. of outdoor air per sq.ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm/sq.ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu.ft./sq.ft. of outside air has been delivered to the space.

   OR

OPTION 2 — Air Testing

• Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED-NC Reference Guide.

• Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

CONTAMINANT	MAXIMUM CONCENTRATION
Formaldehyde	27 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter
* 4-Phenylcyclohexene (4-PCH)	6.5 micrograms per cubic meter
Carbon Monoxide (CO)	9 part per million and no greater than 2 parts per million above outdoor levels
* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.	

• For each sampling point where the maximum concentration limits are exceeded, conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.

• The air sample testing shall be conducted as follows:

a. All measurements shall be conducted prior to occupancy, but during normal occupied hours and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.

b. The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.

c. The number of sampling locations will vary depending upon the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq.ft., or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.

d. Air samples shall be collected between 3 feet and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

6. Implementation and Coordination: Implement the Construction IAQ Management Plan, and coordinate the Plan with all affected trades. Designate one individual as the Construction IAQ Representative at no additional cost to the City of New York, who will be responsible for communicating the progress of the Plan with the Commissioner on a regular basis, and for assembling the required LEED documentation. Include provisions in the Construction IAQ Management Plan for addressing conditions in the field that do not adhere to the Plan, including provisions to implement a stop work order, or to rectify non-compliant conditions.

a. Distribution: The Contractor shall distribute copies of the Construction IAQ Management Plan in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

b. Instruction: The Contractor shall provide on-site instruction of appropriate site management to all Contractor's Subcontractors.

c. Monitoring: The Construction IAQ Representative shall monitor the implementation of the Construction IAQ Management Plan.

1.8 SUBMITTALS:

Submit the following LEED-required records and documents in accordance with Section 01 33 00, SUBMITTAL PROCEDURES and Section 01 81 13, SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS.

A. A copy of the Construction IAQ Management Plan as defined in Sub-Section 1.07 herein.

B. Product cut-sheets for all filtration media used during construction and installed immediately prior to occupancy, with MERV values highlighted. Cut sheets shall be submitted with the Contactor's or Subcontractor's 'approved' stamp as confirmation that the products are the products installed on the project.

C. Provide the Commissioner with a minimum of 18 photographs as required under the provision for Special Photographs, in accordance with Section 01 32 33, PHOTOGRAPHIC DOCUMENTATION, comprised of at least six photographs taken on three different occasions during construction. The photographs shall document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage (to prevent moisture damage). Photographs shall include integral date stamping, and shall be submitted with brief descriptions of the Construction IAQ Management Plan measure documented, or be referenced to project meeting minutes or similar project documents which reference to the Construction IAQ Management Plan measure documented.

D. A copy of the project's TAQ Testing report if applicable.

1.9 QUALITY ASSURANCE:

A. The Contractor shall be responsible for preparing and implementing the Construction IAQ Management Plan and shall coordinate and incorporate the work of its subcontractors in the IAQ Management Plan.

B. Responsibility of Subcontractors: Subcontractors for this project shall be responsible to cooperate with the Contractor in the preparation and implementation of the Construction IAQ Management Plan.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION (Not Used)

END OF SECTION 01 81 19

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

REFER TO THE ADDENDUM FOR APPLICABILITY OF THIS SECTION 01 91 13

PART I – GENERAL

1.1 RELATED DOCUMENTS:

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum, and (5) the Contract [City of New York Standard Construction Contract].

B. OPR and BoD documentation are included by reference for information only.

C. The Commissioning Plan, prepared by the Commissioning Agent (CxA) under separate contract with the City of New York, contains requirements that apply to this section.

1.2 SUMMARY:

A. This Section includes general requirements that apply to implementation of Commissioning without regard to systems, subsystems, and equipment being commissioned.

B. This Section includes:
1. Definitions
2. Commissioning Team
3. City's Responsibilities
4. Each Contractor's Responsibilities
5. Commissioning Authority's/Agent's (CxA) Responsibilities
6. Commissioning Documentation
7. Submittals
8. Coordination

1.3 RELATED SECTIONS: Include without limitation the following:

A. "HVAC Commissioning Requirements" indicated in other sections of the project specifications for specific requirements for commissioning HVAC systems.

B. This project will be commissioned by an independent third party under separate contract with the City of New York. Commissioning shall be in accordance with ASHRAE and USGBC LEED procedures, and specific commissioning requirements of the Project Specifications, whichever is more stringent. The Contractor shall cooperate with the CxA and provide whatever assistance is required.

C. Related Sections include without limitation the following:

1.	Section 01 10 00	SUMMARY
2.	Section 01 31 00	PROJECT MANAGEMENT AND COORDINATION
3.	Section 01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION
4.	Section 01 78 39	CONTRACT RECORD DOCUMENTS
5.	Section 01 79 00	DEMONSTRATION AND OWNERS PRE-ACCEPTANCE ORIENTATION
6.	Section 01 81 13	SUSTAINABLE DESIGN REQUIREMENTS FOR LEED BUILDINGS

1.4 DEFINITIONS:

A. Refer to Article 2 of the Contract for definition of terms, words and expressions used in the General Conditions not otherwise defined herein.

B. Design Consultant: "Design Consultant" shall mean the entity responsible for providing design services for the Project, including without limitation, preparing the construction documents (drawings and specifications) and providing services in connection with such documents during construction. The entity serving as the "Design Consultant" may be a corporation, firm, partnership, joint venture, individual or combination thereof. Such entity may be either an employee(s) of the City or an entity engaged by the City to provide such services.

C. Commissioner: The Commissioner of the Department of Design and Construction of the City of New York, his/her successors, or duly authorized representative(s).

D. BoD: Basis of Design: A document, prepared by the Consultant Architect/Engineer, that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

E. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

F. CxA: Commissioning Agent (Aka Commissioning Authority) under separate contract with the City of New York to provide Commissioning Services for this project.

G. OPR: Owner's (City of New York) Project Requirements: A document, prepared by the Consulting Architect/Engineer) that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

H. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

I. TAB: Testing, Adjusting, and Balancing.

1.5 COMMISSIONING TEAM:

A. Members Appointed by the Contractor and its Subcontractors: Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of the Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by the City:

1. Commissioning Authority/Agent (CxA): The designated person, company, or entity under separate contract with the City that plans, schedules, and coordinates the commissioning team to implement the commissioning process.
2. Representatives of the facility user and operation and maintenance personnel.
3. Consultant Architect/Engineer and other concerned entities.

1.6 CITY'S RESPONSIBILITIES:

A. Provide the OPR documentation to the Commissioning Agent (CxA) for use in developing the commissioning plan; systems manual; operation and maintenance training plan; and testing plans and checklists.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documents, prepared by the Consulting Architect/Engineer and approved by the Commissioner, to the Commissioning Agent (CxA) for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.7 CONTRACTOR'S RESPONSIBILITIES:

A. The Contractor shall provide utility services required for the commissioning process.

B. As a member of the Commissioning Team, the Contractor and subcontractor(s) shall assign representatives with expertise and authority to act on behalf of the Contractor and its subcontractor(s) and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in scheduled construction-phase coordination and commissioning team meetings.
2. Integrate and coordinate commissioning process activities with the construction schedule.
3. Review and accept commissioning process test procedures provided by the CxA.
4. Review and accept construction checklists provided by the CxA.
5. Perform testing required in the Commissioning Schedule as per the Commissioning Process test procedures provided by the CxA.
6. Complete installation checklists as Work is completed and return to CxA through the Resident Engineer.
7. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
8. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
9. Submit As-Built documents, operation and maintenance manuals for systems and subsystems, and equipment in accordance with Section 01 78 39, CONTRACT RECORD DOCUMENTS.
10. Provide orientation sessions for operation and maintenance personnel (sessions will be video recorded by the CxA) in accordance with Section 01 79 00, DEMONSTRATION AND OWNER'S PRE-ACCEPTANCE ORIENTATION.

1.8 COMMISSIONING AGENT'S (CxA) RESPONSIBILITIES:

A. Organize and lead the commissioning team.

B. Prepare a construction-phase commissioning plan. Collaborate through the Resident Engineer with each Contractor and with subcontractors to develop test and inspection procedures. Include design changes and coordinate commissioning activities with the overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.

C. Review and comment in accordance with Section 01 33 00, SUBMITTAL PROCEDURES, on submittals from the Contractor for compliance with the OPR, BoD, Contract Documents, and construction-phase commissioning plan. Review and comment on performance expectations of systems and equipment and interface between systems relating to the OPR and BoD.

D. Coordinate with the Resident Engineer to convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent CxA will prepare and distribute minutes to commissioning team members and attendees within three workdays of the commissioning meeting.

E. At the beginning of the construction phase, coordinate with the Resident Engineer's kick-off meeting schedule to conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals, operation and maintenance training sessions, TAB Work, and Project completion.

F. Observe and inspect construction. Report progress and deficiencies to the Commissioner. In addition to compliance with the OPR, BoD, and Contract Documents, inspect systems and equipment installation for adequate accessibility required for component maintenance replacement and repair.

G. Prepare Project-specific test and inspection procedures and checklists.

H. Coordinate with the Resident Engineer to schedule, direct, witness, and document tests, inspections, and systems startup.

I. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

J. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

K. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the OPR, BoD, and Contract Documents. Operation and maintenance documentation requirements are specified in other sections of the project specifications and described in Section 01 78 39, CONTRACT RECORD DOCUMENTS.

L. Record and edit demonstration and orientation sessions on DVD.

M. Prepare commissioning reports.

N. Assemble the final commissioning documentation, including the commissioning report and Systems Manual.

1.9 COMMISSIONING DOCUMENTATION:

The Contractor shall assist the Commissioning Agent (CxA) in the development and compiling of the following Commissioning Documentation:

A. Index of Commissioning Documents: The Commissioning Agent (CxA) will prepare an index including the storage location of each document.

B. OPR: A written document prepared by the Commissioning Agent (CxA) that details the functional requirements of the Project and expectations of how it will be used and operated. This document includes the Project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

C. BoD Document: A document prepared by the Consulting Architect/Engineer that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that explain the designed systems.

D. Commissioning Plan: A document prepared by the Commissioning Agent (CxA) that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process.

E. Test Checklists: The Commissioning Agent (CxA) will develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. The CxA will prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. Space will be provided for testing personnel to sign off on each checklist. Specific checklist content requirements are specified in other sections of the project specifications.

F. Inspection Checklists will be signed by the Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing.

G. Test and Inspection Reports: The Commissioning Agent (CxA) will record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application will be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

H. Corrective Action Documents: The Commissioning Agent (CxA) will document corrective action taken for systems and equipment that fail tests and include required modifications to systems and equipment and revisions to test procedures, if any. The Contractor shall retest systems and equipment requiring corrective action. The CxA will document retest results.

I. Issues Log: The Commissioning Agent (CxA) will prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the OPR, BoD, and Contract Documents. The log will identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.

1. Commissioning Report: The Commissioning Agent (CxA) will document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report will indicate whether systems, subsystems, and equipment have been completed and are performing according to the OPR, BoD, and Contract Documents.

J. Systems Manual: The Commissioning Agent (CxA) will gather required information and compile systems manual as specified in other sections of the project specifications and described in Section 01 78 39, CONTRACT RECORD DOCUMENTS..

1.10 SUBMITTALS:

A. Commissioning Plan Pre-final Submittal: The Commissioning Agent (CxA) will submit six (6) copies of the pre-final commissioning plan to the Commissioner for review and distribution.

B. Commissioning Plan Final Submittal: The Commissioning Agent (CxA) will submit six (6) hard copies and electronically formatted information of the final commissioning plan to the Commissioner. The final submittal will address previous review comments.

C. Test and Inspection Reports: CxA will submit test and inspection reports.

D. Corrective Action Documents: CxA will submit corrective action documents.

1.11 COORDINATION:

A. Coordinating Meetings: The Commissioning Agent (CxA) will coordinate with the Resident Engineer's regularly scheduled construction progress meetings to conduct coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

B. Pre-testing Meetings: The Commissioning Agent (CxA) will coordinate with the Resident Engineer to conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.

C. Testing Coordination: The Commissioning Agent (CxA) will coordinate with the Resident Engineer the sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Coordinate schedule times with the Resident Engineer for tests, inspections, obtaining samples, and similar activities.

D. Manufacturers' Field Services: The Commissioning Agent (CxA) will coordinate services of manufacturers' field services.

PART II – PRODUCTS (Not Used)

PART III – EXECUTION

3.1 OPERATION & MAINTENANCE MANUALS

A. General
   1. The CxA shall review the Operation & Maintenance manuals provided by the Contractor or subcontractors for completeness of the document. The review process shall verify that Operation & Maintenance instructions meet specifications and are included for all commissioned equipment furnished by the Contractor.
   2. Published literature shall be specifically oriented to the provided equipment, indicating required operation and maintenance procedures, parts lists, assembly / disassembly diagrams and related information.
   3. The Contractor shall incorporate the standard technical literature into system specific formats for this facility as designed and as actually installed. The resulting Operation & Maintenance information shall be system specific, concise, to the point and tailored specifically to this facility. The CxA shall review these documents as necessary for final corrections by the Contractor.

B. The Operation & Maintenance Manual review and coordination efforts shall be completed prior to Owner orientation sessions, as these documents are to be utilized in the training sessions.

C. System Operations Manual
   1. The CxA shall prepare and deliver these documents with inputs from other agencies. The contractors will confirm the proper documents are onsite and readily available. Typically, the manual includes the following:
      a. Commissioned systems single line diagrams (Mechanical, Electrical, Plumbing, and Building Management System (BMS) subcontractors).
      b. As built sequences of operations, control drawings and original set points (Design Consultant and BMS subcontractor)
      c. Operating instructions for integrated building systems (mechanical and BMS subcontractors).
      d. Recommended schedule of maintenance requirements and frequency (subcontractors).
      e. Recommended schedule for calibrating sensors and actuators (BMS subcontractor)

3.2 DEMONSTRATION AND INSTRUCTION

A. The Contractor shall schedule and coordinate instruction sessions for the facility's staff for each commissioned system. Demonstrations shall be held per Contract Documents, along with the appropriate schematics, handouts and visual / audio training aids onsite with equipment.

B. The equipment vendors shall provide instruction on the specifics of each major equipment item including philosophy, troubleshooting and repair techniques.

C. For additional prescription pertinent to instruction, refer to other specific divisions for demonstration and instruction requirements.

3.3 WARRANTY REVIEW / SEASONAL TESTING

A. The CxA will return upon the start of the new season (cooling or heating) after project completion to conduct performance tests that could not be performed due to ambient conditions. The seasonal testing will only be performed if unsuitable loads / conditions were unavailable during the performance testing stages (in other words; the requirement for testing is warranted).

B. If agreed upon by facility, Seasonal Testing can also be used for the Warranty Review. During which the CxA will interview the occupants, maintenance staff, review the operation of the building, provide recommendations for installation and operational problems and document warranty and operational issues in the issues database.

3.4 RECORD DRAWINGS

A. The CxA shall review the as built contract documents to verify incorporation of both design changes and as built construction details. Discrepancies noted shall be corrected by the appropriate party.

END OF SECTION 01 91 13

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

30-30 THOMSON AVENUE LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000 WEBSITE www.nyc.gov/buildnyc

NYC DDC
Department of Design and Construction

Contract for Furnishing all Labor and Material Necessary

Contractor

Dated _____ , 20 _____

Approved as to Form
Certified as to Legal Authority

Acting Corporation Counsel

Dated _____ , 20 _____

Entered in the Comptroller's Office

First Assistant Bookkeeper

Dated _____ , 20 _____

Department of Design and Construction

PROJECT ID: CRO-AGS

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

30-30 THOMSON AVENUE
LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000
WEBSITE www.nyc.gov/buildnyc

VOLUME 3 OF 3

ADDENDUM TO THE GENERAL CONDITIONS

SPECIFICATIONS

FOR FURNISHING ALL LABOR AND MATERIALS
NECESSARY AND REQUIRED FOR:

Croton New Above Ground Structure and Landscaping Rebid

LOCATION: 3651 Jerome Avenue
BOROUGH: Bronx, NY 10467
CITY OF NEW YORK

CONTRACT NO. 1 GENERAL CONSTRUCTION WORK

NYC Department of Environmental Protection

Grimshaw Architects

Date: October 26, 2017

8-028

Department of Design and Construction

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS

ADDENDUM TO THE GENERAL CONDITIONS FOR SINGLE CONTRACT PROJECTS

The General Conditions are hereby amended in accordance with the terms and conditions set forth in this Addendum.

I. PROJECT DESCRIPTION

FMS #: **CRO-AGS**

PROJECT NAME: **Croton Above Ground Structure and Landscaping**

PROJECT DESCRIPTION: This Project consists of a clubhouse and landscape features for the Mosholu Golf Course, a Wetland Cell System which filters storm water and groundwater for re-use by the golf course irrigation system, and Security Features which protect the adjacent DEP Croton Water Treatment Plant facility. The entire site is located within Van Courtland Park and the aim of the project is to integrate the new facility into the surrounding landscape. Design & construction of the project is required to comply with New York City Local Law 86 as the energy performance benchmark and must qualify for LEED Silver certification or higher. All construction trades will be required to contribute to the energy performance, sustainability, and LEED goals of the project.

PROJECT LOCATION: **3651 Jerome Avenue**
BOROUGH: **Bronx**
CITY OF NEW YORK
ZIP CODE: **10467**
COMMUNITY BOARD #: **Bronx Community Boards 7, 8, 12**
LANDMARK STATUS:

DESIGNATED LANDMARK STRUCTURE OR SITE: **NO**
If this is a Designated Landmark Structure or Site, Section 01 3591, Historic Treatment Procedures applies to this project.
LANDMARK QUALITY STRUCTURE: **NO**
If this is a Landmark Quality Structure, Section 01 3591, Historic Treatment Procedures applies to this project.

II. LEED GREEN BUILDING REQUIREMENTS

This project must achieve a Silver LEED Green Building Rating. A certain number of credits are required for this rating and are detailed in the Project Specifications. Sections 01 8113 Sustainable Design Requirements for LEED Buildings, 01 8113.13 VOC Limits for Adhesives, Sealants, Paints and Coatings for LEED Buildings, 01 8119 Indoor Air Quality Requirements for LEED Buildings, and 01 9113 General Commissioning Requirements of the DDC Standard General Conditions shall apply to this project.

III. COMMISSIONING REQUIREMENTS

This project includes Commissioning Requirements. The General Commissioning Requirements are found in Section 01 9113 of the DDC Standard General Conditions. Other specific Commissioning Requirements can be found in the Project Specification Sections.

IV. PROJECT MANAGEMENT

☐ DDC shall publicly bid and enter into all contracts for the Project. DDC shall manage the Project using its own personnel.

☒ DDC shall publicly bid and enter into all contracts for the Project. A Construction Management firm (the "CM") hired by DDC shall manage the Project. The Contractor is advised that the CM shall serve as the representative of the Commissioner at the site and shall, subject to review by the Commissioner, be responsible for the inspection, management, coordination and administration of the required construction work, as delineated in the article of the Standard Construction Contract entitled "The Resident Engineer".

V. CONTRACTS FOR THE PROJECT

The Project consists of a single contract, the Contract for General Construction Work. The Contractor for General Construction Work is responsible for the performance of all required work for the Project as set forth in the Contract Documents (General Conditions, Drawings and Specifications), including all responsibilities and obligations assigned to separate Contractors for the following subdivisions of the work: Plumbing Work, HVAC Work, and Electrical Work. All responsibilities and obligations in the Contract Documents assigned to separate Contractors for such subdivisions of the work are the responsibility of the Contractor for General Construction Work.

VI. SCHEDULES

The Contractor is advised that Schedules A through F are attached to, and incorporated as part of, this Addendum to the General Conditions. These schedules contain important information that is specific to this Project. The Contractor is advised to carefully review these schedules.

VII. APPLICABILITY OF SECTIONS/SUB-SECTIONS AND AMENDED SUB-SECTIONS

The Contractor is advised that various Sections/Sub-Sections in the General Conditions may not apply to this Project or may apply as amended. Such Sections/Sub-Sections advise the Contractor to "Refer to the Addendum for the applicability of this Section/Sub-Section." Such Sections/Sub-Sections are set forth below. A check mark indicates whether the Section/Sub-Section (1) applies to the Project, (2) does not apply to the Project, or (3) applies to the Project as amended. If no box is checked, the Section/Sub-Section, as set forth in the General Conditions, applies to the Project. Amended Sections/Sub-Sections, if any, are set forth following this list of Sections.

Section	Sub-Section	Sub-Section	Applies	Does not Apply	Applies as Amended
01 1000	1.4 (B)	Scope and Intent / LEED	X		
	1.4(C)	Scope and Intent / Commissioning	X		
01 3233		Photographic Documentation	X		
01 3300	1.7 (A-D)	LEED Submittals	X		
01 3503		General Mechanical Requirements	X		
01 3506	3.2 (A-B)	Electrical Conduit System Including Boxes (Pull, Junction and Outlet)	X		
	3.3 (A-E)	Electrical Wiring Devices	X		
	3.4 (A-I)	Electrical Conductors and Terminations	X		
	3.5 (A-B)	Circuit Protective Devices	X		
	3.6 (A-J)	Distribution Centers	X		
	3.7 (A-I)	Motors	X		
	3.8 (A-I)	Motor Control Equipment	X		
01 3591		Historic Treatment Procedures		X	
01 5000	3.2 (A)	Temporary Water Facilities / Temporary Water	X		
	3.2 (B)	Temporary Water Facilities / Temporary Water – Work in Existing Facilities	X		
	3.3 (B)	Temporary Sanitary Facilities / Self-Contained Toilet Units	X		
	3.3 (C)	Temporary Sanitary Facilities / Existing Toilets	X		
	3.4 (B) 1	Temporary Power, Lighting, and Site Lighting / Connection to Utility Lines	X		
01 5000	3.4 (B) 2	Temporary Power, Lighting, and Site Lighting / Connection to Existing Electrical Power Service	X		
	3.4 (B) 3	Temporary Power, Lighting, and Site Lighting / Electrical Generator Power Service	X		
	3.4 (D)	Temporary Power, Lighting, and Site Lighting / Temporary Lighting	X		
	3.4 (E)	Temporary Power, Lighting, and Site Lighting / Site Security Lighting (for New Construction Only)	X		
	3.5 (A-J)	Temporary Heat	X		
	3.8 (A)	DDC Field Office / Office Space in Existing Building	X		
	3.8 (B)	DDC Field Office / DDC Field Office Trailer	X		
	3.8 (B-3a)	DDC Field Office / DDC Managed Field Office Trailer		X	
	3.8 (B-3b)	DDC Field Office / CM Managed Field Office Trailer	X		
	3.8 (D)	DDC Field Office / Additional Equipment for the DDC Field Office	X		
	3.13(A-D)	Work Fence Enclosure	X		
	3.17(B)	Project Rendering	X		
	3.18 (A-C)	Security Guards / Fire Guards on Site	X		

Section	Sub-Section	Sub-Section	Applies	Does not Apply	Applies as Amended
01 5411	3.1 (A-J)	Temporary Use, Operation and Maintenance of Elevators During Construction for New Buildings Up To and Including 15 Stories		X	
	3.2 (A-M)	Temporary Use, Operation and Maintenance of Elevators During Construction for New Buildings Over 15 Stories		X	
	3.3 (A-E)	Temporary Use, Operation and Maintenance of Elevators During Construction for Existing Buildings		X	
01 7300	3.3 (A-I)	Surveys	X		
	3.4 (A-B)	Borings	X		
	3.12 (A-D)	Sleeves and Hangers	X		
	3.13 (A)	Sleeve and Penetration Drawings	X		
	3.15 (A)	Location of Partitions	X		
01 7419	1.5 (C)	Waste Management Performance Requirements / LEED Certification	X		
01 790		Demonstration and Owner's Pre-Acceptance Orientation	X		
01 8113		Sustainable Design Requirements for LEED Buildings	X		
01 8113.13		VOC Limits for Adhesives, Sealants, Paints and Coatings for LEED Buildings	X		
01 8119		Indoor Air Quality Requirements for LEED Buildings	X		
01 9113		General Commissioning Requirements	X		

ADDITIONAL SECTIONS/SUB-SECTIONS

The Contractor is advised that the additional Sub-Sections set forth below are included in the General Conditions and apply to the Project.

The Contractor is advised that any references to the original FMS# HED-CLUB are deemed deleted and replaced with the current FMS# CRO-AGS.

VIII. SPECIAL EXPERIENCE REQUIREMENTS FOR THE PROJECT

(1) **GENERAL**: Special Experience Requirements for the Project are set forth below. Such Special Experience Requirements may apply to either or both of the following entities: (a) the contractor or subcontractor that will perform specific areas of work, and/or (b) the manufacturer that will provide specific material or equipment.

(2) **REVISION OF SPECIFICATIONS AND DRAWINGS**: In the event the Specifications and/or the Contract Drawings contain any Special Experience Requirements that are not set forth below, such Special Experience Requirements are deemed deleted, except as otherwise expressly provided in Section VIII of this Addendum.

(3) **SPECIAL EXPERIENCE REQUIREMENTS FOR SPECIFIC AREAS OF WORK**: The Special Experience Requirements set forth below apply to the contractor or subcontractor that will perform specific areas of work. Compliance with such Special Experience Requirements will be evaluated after an award of contract. Within two (2) weeks of such award, the contractor will be required to submit the qualifications of the contractor or subcontractor that will perform these specific areas of work. If the contractor intends to perform any specific area of work with its own forces, it must demonstrate compliance with the Special Experience Requirements. If the contractor intends to subcontract any specific area of work, the proposed subcontractor(s) must demonstrate compliance with the Special Experience Requirements. Once approved, no substitution will be permitted, unless the qualifications of the proposed replacement have been approved in writing in advance by the City.

(a) Special Experience Requirement #1: The contractor or subcontractor that will perform the specific areas of work specified above must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

(b) Special Experience Requirement #2: For Section 073360 Vegetated Roofing System, the contractor or subcontractor performing the work of these sections must be a company regularly engaged in performing roofing projects with its own workforce and have successfully completed in a timely fashion at least three (3) roofing projects similar in scope, size and type to the required work within the last three (3) consecutive years prior to the bid opening. At least one of those projects must have been performed within the last twelve (12) months. The three (3) qualifying projects must have utilized one or more of the roofing systems specified for the project being bid herein, been installed by the contractor's or subcontractor's company utilizing its own workforce and must have qualified for, and have been issued, the warranty provided by the manufacturer of the roofing system. In addition, the contractor or subcontractor must be a certified or authorized installer for at least one of the manufacturer's roofing systems specified herein and shall submit proof of same.

General Construction Work:

- Section 033519: Polished Concrete Floor Finishing
- Section 034500: Architectural Precast Concrete
- Section 034900: Glass Fiber Reinforced Concrete (GFRC) Panels
- Section 044010: Gabion Site Walls
- Section 044200: Exterior Stone Cladding
- Section 051213: Architecturally Exposed Structural Steel (AESS)
- Section 064023: Architectural Woodwork
- Section 073360: Vegetated Roofing System
- Section 084113: Aluminum Framed Entrances and Structural Glass Curtain Walls
- Section 114800: Athletic and Recreational Equipment
- Section 321217: Aggregate Overlay Over Asphalt
- Section 321313: Concrete Paving
- Section 321314: Cast in Place Concrete Paving - Pervious
- Section 327200: Planting for Wetland Areas
- Section 334713: Wetland Liners

(4) **SPECIAL EXPERIENCE REQUIREMENTS FOR MANUFACTURERS**: The special experience requirements set forth below apply to the manufacturer that will supply or fabricate specific material or equipment. Compliance with such experience requirements will be evaluated after an award of contract. Within two (2) weeks of award, the contractor will be required to submit the qualifications of the proposed manufacturer(s). Once approved, no substitution will be permitted, unless the qualifications of the proposed replacement have been approved in writing in advance by the City

(a) Special Experience Requirement #1: The manufacturer providing the material or equipment specified in this section must, for the past five (5) years, have been regularly engaged in the manufacture of material or equipment similar in type to that required for this Project. Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years. In addition, for Precast Concrete, the manufacturer must be certified by the PreCast Institute (PCI). This Special Experience Requirement applies to the manufacturer that will provide material or equipment specified in the section(s) set forth below.

General Construction Work:

- Section 034500: Architectural Precast Concrete
- Section 034900: Glass Fiber Reinforced Concrete (GFRC) Panels
- Section 073360: Vegetated Roofing System
- Section 084113: Aluminum Framed Entrances and Structural Glass Curtain Walls
- Section 114800: Athletic and Recreational Equipment

IX. REVISIONS: SPECIFICATIONS AND CONTRACT DRAWINGS

The Specifications and the Contract Drawings for the Project are revised in accordance with the provisions set forth below.

(1) Owner: Wherever the term "Owner" is used in the Specifications and/or the Contract Drawings, such term shall mean the City of New York.

(2) Other Entities: In the event any entity other than the City of New York is referred to or named as the "Owner" in the Specifications and/or the Contract Drawings, the name of such other entity is deemed deleted and replaced with the "City of New York".

(3) Architect / Engineer: Wherever the words "Architect", "Engineer", "Architect / Engineer" or "Architect and/or Engineer" are used in the Specifications and/or the Contract Drawings, such words are deemed deleted and replaced with the word "Commissioner".

(4) Products / Manufacturers: Wherever the Specifications and/or the Contract Drawings require the contractor to provide a particular product (i.e., material and/or equipment) from a designated manufacturer and/or vendor, the term "or approved equal" is deemed inserted, even if only one product and/or manufacturer is specified, except as otherwise provided below.

(a) Proprietary Items: If the Bid Booklet contains a Notice which identifies a particular product from a designated manufacturer as a "Proprietary Item", the Contractor shall be required to provide such specified product. In such case, no substitution or "approved equal" will be permitted.

(5) Special Experience Requirements: Special Experience Requirements for the Project, if any, are set forth in the Bid Booklet. Special Experience Requirements may apply to contractors, subcontractors, installers, manufacturers and/or suppliers. If the Specifications and/or the Contract Drawings contain any Special Experience Requirement that is not set forth in the Bid Booklet, such Special Experience Requirement is deemed deleted, except as otherwise provided below.

(a) Any Special Experience Requirement that provides that the entity performing the work or supplying the material must have more than three (3) years of experience, is revised to provide that the entity performing the work or supplying the material must have three (3) years of experience, except as described in paragraph (b) below.
(b) Any Special Experience Requirement that pertains to the abatement of hazardous materials shall not be subject to the deletion and/or revision set forth above. Such Special Experience Requirement shall remain in full force and effect.
(c) Any Special Experience Requirement that provides that the entity performing the work must be licensed, authorized, certified, approved by or acceptable to the manufacturer, is deemed deleted and replaced with the requirement that such entity must be properly trained for the specified work.
(d) Any Special Experience Requirement that provides that the individual workers performing the work must be licensed, authorized, certified, approved by or acceptable to the manufacturer, is deemed deleted and replaced with the requirement that such individual workers must be properly trained for the specified work.

(6) Alternate Bids: If the agency is requesting the submission of Alternate Bids, a Notice regarding such Alternate Bids is set forth in the Bid Booklet. In the event of any conflict or inconsistency between (1) the Notice regarding Alternate Bids set forth in the Bid Booklet and (2) a provision in the Specifications and/or the Contract Drawings regarding Alternate Bids, the Notice set forth in the Bid Booklet shall prevail. If the agency is not requesting the submission of Alternate Bids, as indicated by the absence of a Notice in the Bid Booklet, and the Specifications and/or the Contract Drawings contain any provision regarding Alternate Bids, such provision is deemed deleted.

(7) Contractor Retained Engineer: If the Specifications and/or the Contract Drawings require the Contractor to retain an Engineer to provide engineering services for the Project, the following sentence is deemed inserted: "Such Engineer must be a Professional Engineer, licensed in the State of New York."

(8) LEED Related Provisions: If the Specifications and/or the Contract Drawings require the Contractor to purchase FSC certified wood, rapidly renewable materials, or materials within 500 miles, such provisions are deemed deleted and replaced with the requirement that if the contractor has purchased FSC certified wood, rapidly renewable materials, or materials within 500 miles, the contractor shall submit such forms or documentation as may be required by the City in order for the USGBC to certify that the Project qualifies for the related LEED credit(s).

(9) Guarantees: Requirements for Guarantees and Maintenance are set forth in Schedule B, which is included in the Addendum to the General Conditions. In the event of any conflict or inconsistency between (1) a guarantee and/or maintenance requirement set forth in the Specifications and/or the Contract Drawings and (2) a guarantee and/or maintenance requirement set forth in Schedule B, the guarantee and/or maintenance requirement set forth in Schedule B shall prevail.

(10) Warranties: Requirements for Warranties are set forth in Schedule B, which is included in the Addendum to the General Conditions.

(a) In the event of any conflict or inconsistency between (1) a warranty requirement set forth in the Specifications and/or the Contract Drawings and (2) a warranty requirement set forth in Schedule B, the warranty requirement set forth in Schedule B shall prevail.
(b) In the event a warranty requirement set forth in the Specifications and/or the Contract Drawings is omitted from Schedule B, such omission from Schedule B shall have no effect and the Contractor's obligation to provide the manufacturer's warranty, as set forth in the Specifications and/or the Contract Drawings, shall remain in full force and effect.
(c) In the event a warranty requirement for a particular item of material or equipment is omitted from Schedule B, as well as from the Specifications or the Contract Drawings, and the manufacturer of such item actually provides a warranty, the Contractor shall be obligated to obtain and deliver to the Commissioner the highest level of warranty actually provided by that manufacturer.

(11) Exculpatory Provisions: In the event the Specifications and/or the Contract Drawings contain any provision whereby the consultant and/or any of its officers, employees or agents, including subconsultants, is absolved of responsibility for any act or omission, such provision is deemed deleted.

(12) Insurance: Provisions regarding insurance coverage the Contractor is required to provide are set forth in Article 22 of the City of New York Standard Construction Contract and Schedule A, which is included in the Addendum to the General Conditions. In the event the Specifications and/or the Contract Drawings contain any provision regarding insurance requirements, such provision is deemed deleted.

(13) Indemnification: Provisions regarding indemnification are set forth in Articles 7, 12, 22 and 57 of the City of New York Standard Construction Contract. In the event the Specifications and/or the Contract Drawings contain any provision regarding indemnification, such provision is deemed deleted.

(14) Dispute Resolution: Provisions regarding dispute resolution are set forth in Article 27 of the City of New York Standard Construction Contract. In the event the Specifications and/or the Contract Drawings contain any provision regarding dispute resolution, such provision is deemed deleted.

(15) Payment to Other Entities: In the event the Specifications and/or the Contract Drawings contain any provision which requires the Contractor to make payments to an entity other than a subcontractor and/or supplier providing services and/or material for the project, such provision is deemed deleted.

(16) General Conditions: In the event of any conflict or inconsistency between (1) the Specifications and/or the Contract Drawings and (2) the General Conditions, the General Conditions shall prevail.

(17) Standard Construction Contract: In the event of any conflict or inconsistency between (1) the Specifications and/or the Contract Drawings and (2) the City of New York Standard Construction Contract, the City of New York Standard Construction Contract shall prevail.

SCHEDULE A (FOR PUBLICLY BID PROJECTS)
PART I - Contract Requirements

Various Articles of the Contract refer to requirements which are set forth in Schedule A of the General Conditions. The Schedule set forth below specifies the following: (1) the referenced Articles of the Contract, and (2) the specific requirements applicable to the contract.

REFERENCE	ITEM	REQUIREMENTS	CONTRACT #1	
Information For Bidders	Bid Security		See Attachment 1 – Bid Information in the Bid Booklet	
Information For Bidders	Performance and Payment Bonds		See Attachment 1- Bid Information in the Bid Booklet	
Article 14 Contract	Time of Substantial Completion	Consecutive Calendar Days	**900**	
Article 15 Contract	Liquidated Damages	For each consecutive calendar day over completion time	**$600**	
Article 17 Contract	Sub-Contracts	Not to exceed Percent of Contract Price	**60%**	
Article 21 Contract	Retainage	Percent of Voucher	If 100% bonds are required	**5%**
			If 100% bonds are not required, and Contract Price is $1,000,000 or less	**5%**
			If 100% bonds are not required, and Contract Price is more than $1,000,000	**10%**
Article 24 Contract	Deposit Guarantee	Percent of Contract Price	**1%**	
Article 24 Contract	Period of Guarantee		See Schedule B of the Addendum to the General Conditions	
Article 74 Contract	Statement of Work		Addenda, numbered: _____	
Article 75 Contract	Compensation to be Paid to Contractor		Amount for which the Contract was Awarded: _____ _____ Dollars ($_____)	
Article 79 Contract	MWBE Program		See M/WBE Utilization Plan in the Bid Booklet	

SCHEDULE A./ (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART II. Types of Insurance, Minimum Limits and Special Conditions

Note: All certificate(s) of insurance submitted pursuant to Contract Article 22.3. 3 must be accompanied by a Certification by Broker consistent with Part III below and include the following information:

- For each insurance policy, the name and NAIC number of issuing company, number of policy, and effective dates;
- Policy limits consistent with the requirements listed below;
- Additional insureds or loss payees consistent with the requirements listed below; and
- The number assigned to the Contract by the City (in the "Description of Operations" field).

Insurance indicated by a blackened box (■) or by (X) in the ☐ to left will be required under this contract.

Types of Insurance (per Article 22 in its entirety, including listed paragraph)	Minimum Limits and Special Conditions
■ Commercial General Liability Art. 22.1.1	The minimum limits shall be $1,000,000.00 per occurrence and $2,000,000.00 per project aggregate applicable to this **Contract.** Additional Insureds: 1. City of New York, including its officials and employees, with coverage at least as broad as ISO Forms CG 20 10 and CG 20 37, and 2. All person(s) or organization(s), if any, that Article 22.1.1(b) of the **Contract** requires to be named as Additional Insured(s), with coverage at least as broad as ISO Form CG 20 26. The Additional Insured endorsement shall either specify the entity's name, if known, or the entity's title (e.g., Project Manager). 3. _____
■ Workers' Compensation Art. 22.1.2 ■ Disability Benefits Insurance Art. 22.1.2 ■ Employers' Liability Art. 22.1.2 □ Jones Act Art. 22.1.3 □ U.S. Longshoremen's and Harbor Workers Compensation Act Art. 22.1.3	Workers' Compensation, Employers' Liability, and Disability Benefits Insurance: Statutory per New York State law without regard to jurisdiction. **Note**: The following forms are acceptable: (1) New York State Workers' Compensation Board Form No. C-105.2, (2) State Insurance Fund Form No. U-26.3, (3) New York State Workers' Compensation Board Form No. DB-120.1 and (3) Request for WC/DB Exemption Form No. CE-200. The City will not accept an ACORD form as proof of Workers' Compensation or Disability Insurance. Jones Act and U.S. Longshoremen's and Harbor Workers' Compensation Act: Statutory per U.S. law.

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART II. Types of Insurance, Minimum Limits and Special Conditions

Insurance indicated by a blackened box (■) or by (X) in the ☐ to left will be required under this contract.

Types of Insurance (per Article 22 in its entirety, including listed paragraph)		Minimum Limits and Special Conditions
■ Builders' Risk	Art. 22.1.4	100 % of total value of **Work** **Contractor** the Named Insured; the **City** both an Additional Insured and one of the loss payees as its interests may appear. If the **Work** does not involve construction of a new building or gut renovation work, the **Contractor** may provide an installation floater in lieu of Builders Risk insurance. Note: Builders Risk Insurance may terminate upon **Substantial Completion** of the **Work** in its entirety.
■ Commercial Auto Liability	Art. 22.1.5	$1,000,000.00 per accident combined single limit If vehicles are used for transporting hazardous materials, the **Contractor** shall provide pollution liability broadened coverage for covered vehicles (endorsement CA 99 48) as well as proof of MCS 90
☐ Contractor's Pollution Liability	Art. 22.1.6	$_____ per occurrence $_____ aggregate Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3. _____
☐ Marine Protection and Indemnity	Art. 22.1.7(a)	$_____ per occurrence $_____ aggregate Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3. _____

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART II. Types of Insurance, Minimum Limits and Special Conditions (Continued)

Insurance indicated by a blackened box (■) or by (X) in the ☐ to left will be required under this contract.

Types of Insurance (per Article 22 in its entirety, including listed paragraph)	Minimum Limits and Special Conditions
☐ Hull and Machinery Insurance Art. 22.1.7(b)	$_____ per occurrence $_____ aggregate Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3. _____
☐ Marine Pollution Liability Art. 22.1.7(c)	$_____ each occurrence Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3.
[OTHER] Art. 22.1.8 ☐ Ship Repairers Legal Liability	$_____ each occurrence
[OTHER] Art. 22.1.8 ☐ Collision Liability/Towers Liability	$_____ per occurrence $_____ aggregate Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3. _____
[OTHER] Art. 22.1.8 ☐ Railroad Protective Liability _____	$_____ per occurrence $_____ aggregate Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3. _____

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART II. Types of Insurance, Minimum Limits and Special Conditions (Continued)

Insurance indicated by a blackened box (■) or by (X) in the ☐ to left will be required under this contract.

[OTHER] Art. 22.1.8 □ Asbestos Liability _____	Only required of the Contractor or Subcontractor performing any required asbestos removal. $1,000,000 each occurrence, $2,000,000 aggregate (Combined Single Limit); only required of the Contractor or Subcontractor performing any required asbestos removal. Additional Insureds: 1. City of New York, including its officials and employees, and 2. _____ 3. _____
[OTHER] Art. 22.1.8 ■ Boiler Insurance_____	$200,000
[OTHER] Art. 22.1.8 ■ Professional Liability In the event any section of the Specifications requires the Contractor to engage a Professional Engineer to provide design and/or engineering services, the Engineer engaged by the Contractor, as well as any sub consultant(s) performing professional services, shall provide Professional Liability Insurance.	$1,000,000 per occurrence The Contractor's Professional Engineer shall maintain and submit evidence of Professional Liability Insurance in the minimum amount of $1,000,000 per claim. The policy or policies shall include an endorsement to cover the liability assumed by the Contractor under this Agreement arising out of the negligent performance of professional services or caused by an error, omission or negligent act of the Contractor's Professional Engineer or anyone employed by the Contractor's Professional Engineer. Claims-made policies will be accepted for Professional Liability Insurance. All such policies shall have an extended reporting period option or automatic coverage of not less than two (2) years. If available as an option, the Contractor's Professional Engineer shall purchase extended reporting period coverage effective on cancellation or termination of such insurance unless a new policy is secured with a retroactive date, including at least the last policy year.

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART III. Certificates of Insurance

All certificates of insurance (except certificates of insurance solely evidencing Workers' Compensation Insurance, Employer's Liability Insurance, and/or Disability Benefits Insurance) must be accompanied by one of the following:

(1) the Certification by Insurance Broker or Agent on the following page setting forth the required information and signatures;

-- OR --

(2) copies of all policies as certified by an authorized representative of the issuing insurance carrier that are referenced in such certificate of insurance. If any policy is not available at the time of submission, certified binders may be submitted until such time as the policy is available, at which time a certified copy of the policy shall be submitted.

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART III. Certification by Insurance Broker or Agent

The undersigned insurance broker or agent represents to the City of New York that the attached Certificate of Insurance is accurate in all material respects.

_____

[Name of broker or agent (typewritten)]

_____

[Address of broker or agent (typewritten)]

_____

[Email address of broker or agent (typewritten)]

_____

[Phone number/Fax number of broker or agent (typewritten)]

_____

[Signature of authorized official or broker or agent]

_____

[Name and title of authorized official, broker or agent (typewritten)]

State of .....)
) ss:
County of .....)

Sworn to before me this

_____ day of _____, 20__

_____

NOTARY PUBLIC FOR THE STATE OF_____

SCHEDULE A (FOR PUBLICLY BID PROJECTS)

Relating to Article 22 - Insurance

PART IV. Address of Commissioner

Wherever reference is made in Article 7 or Article 22 to documents to be sent to the **Commissioner** (e.g., notices, filings, or submissions), such documents shall be sent to the address set forth below or, in the absence of such address, to the **Commissioner's** address as provided elsewhere in this **Contract**.

ACCO's Office, Insurance Unit

30-30 Thomson Avenue, 4th Floor

Long Island City, New York 11101

SCHEDULE B

Guarantees and Warranties

(Reference: Section 01 7839, Article 2.7 of the DDC Standard General Conditions)

GUARANTY FROM CONTRACTOR

(1) Contractor's Guaranty Obligation: The Contractor shall promptly repair, replace, restore or rebuild, as the Commissioner may determine, any finished Work in which defects of materials or workmanship may appear or to which damage may occur because of such defects, during the one (1) year period subsequent to the date of Substantial Completion (or use and occupancy in accordance with the Contract), except for the areas of Work set forth below:

- Roofing, Waterproofing, and Joint Sealant Work. For these types of work, the guarantee period shall be (2) two years.

- Trees and/or Plant Material. For trees and/or plant material furnished and installed, the guarantee period shall be (2) two years. During the guarantee period, the Contractor shall provide all maintenance services set forth in the Specifications.

(2) Guaranty Period: The obligation of the Contractor, and its Surety under the Performance Bond, is limited to the period(s) of time specified above.

(3) Other Provisions Deemed Deleted: In the event the Specifications and/or the Contract Drawings contain any provisions regarding guaranty requirements, such provisions are deemed deleted and replaced with the guaranty requirements set forth in this Schedule B.

****

WARRANTY FROM MANUFACTURER

(1) Contractor's Obligation to Provide Warranties: The items of material and/or equipment for which manufacturer warranties are required are listed below. For each item of material and/or equipment listed below, the Contractor shall obtain a written warranty from the manufacturer. Such warranty shall provide that the material or equipment is free from defects for the period set forth below and will be replaced or repaired within such specified period. The Contractor shall deliver all required warranties to the Commissioner.

(2) Required Warranties:

Specification Number	Material or Equipment	Warranty Period
034500	*Architectural Precast Concrete*	*1*
044020	*Exterior Stone Rockery*	*1*
051250	*Netting Barrier System Netting & Cables*	*5*
051250	*Netting Barrier System Steel Masts*	*10*
071326	*Sheet Membrane Waterproofing*	*10*
071413	*Fluid Membrane Waterproofing*	*10*
072423	*Direct Applied Soffit Finish System*	*2*
072713	*Non Permeable Air Vapor Barrier Membrane*	*5*
073360	*Vegetated Roofing System*	*20*
076200	*Sheet Metal Flashing & Trim*	*2*
081416	*Wood Doors*	*Life of Installation*
084113	*Aluminum Framed Entrances & Glass CW - Special*	*10*
084113	*Aluminum Framed Entrances & Glass CW - Finishes*	*10*
088000	*Glass & Glazing Insulating Glass*	*10*

088000	*Glass & Glazing Coated & Laminated Glass*	*5*
089000	*Louvers*	*20*
096813	*Carpet*	*10*
102226	*Operable Partitions*	*1*
109000	*Parking / Access Control Gate*	*1*
110100	*Fall Protection*	*5*
122413	*Window Shades*	*25*
133123	*Tensioned Fabric Structures*	*10*
221329	*Sanitary Sewerage Pumps*	*5*
221329	*Sanitary Sewerage Pump Motors*	*20*
221413	*Facility Storm Drainage Piping*	*10*
223400	*Fuel Fired Domestic Water Heaters Storage Tank*	*5*
223400	*Fuel Fired Domestic Water Heaters Controls*	*2*
230533	*Heat Tracing for HVAC Piping*	*10*
230900	*Instrumentation and Control for HVAC*	*5*
235533	*Fuel Fired Unit Heaters*	*5*
235700	*Heat Exchangers For HVAC*	*2*
237200	*Air to Air ERV – Packaged ERV*	*2*
237200	*Air to Air ERV – Heat Exchanger*	*10*
238146	*Water Source Unitary Heat Pumps*	*5*
238316	*Radiant Heating Hydronic Piping Pex Tubing*	*30*
238316	*Radiant Heating Hydronic Piping Manifolds*	*5*
238316	*Radiant Heating Hydronic Piping Controls*	*2*
262413	*Switchboards*	*5*
262416	*Panel boards*	*5*
262923	*Variable Frequency Motor Controllers*	*5*
263323	*Central Battery Equipment – Full Warranty*	*1*
263323	*Central Battery Equipment – Pro Rata*	*9*
265100	*Lighting Fixtures & Devices Ballasts - Electronic*	*5*
265100	*Lighting Fixtures & Devices Ballasts - Electromagnetic*	*3*
320516	*Aggregate Paving*	*60 Days*
321217	*Aggregate Overlay over Asphalt Paving*	*1*
321400	*Unit Pavers*	*60 Days*
328000	*Irrigation System*	*1*
328001	*Irrigation Pump Station*	*1*

(3) Application: The obligations under the warranty for the periods specified above shall apply only to the manufacturer of the material or equipment, and not to the Contractor or its Surety; provided, however, the Contractor retains responsibility for obtaining all required warranties from the manufacturers and delivering the same to the Commissioner.

(4) Other Provisions: The warranty requirements set forth in this Schedule B are also included in the Specifications.

(a) In the event of any conflict between a warranty requirement set forth in the Specifications and a warranty requirement set forth in Schedule B, the warranty requirement set forth in Schedule B shall take precedence.

(b) In the event a warranty requirement set forth in the Specifications is omitted from Schedule B, such omission from Schedule B shall have no effect and the Contractor's obligation to provide the manufacturer's warranty, as set forth in the Specifications, shall remain in full force and effect

(c) In the event a warranty requirement for a particular item of material or equipment is omitted from both

Schedule B and the Specifications, and the manufacturer of such item actually provides a warranty, the Contractor shall be obligated to obtain and deliver to the Commissioner the highest level of warranty actually provided by that manufacturer.

(d) In the event a warranty requirement is provided for a particular item of material or equipment, and such requirement specifies a warranty period that is longer than that which is actually provided by any of the specified manufacturers, the Contractor shall be obligated to obtain and deliver to the Commissioner the highest level of warranty actually provided by any of the specified manufacturers, unless otherwise directed in writing by the Commissioner.

(e) Unless indicated otherwise Warranties are to take effect on the date of Substantial Completion.

SCHEDULE C

Contract Drawings

(Reference: Section 01 1000, Article 1.5 (A) of the DDC Standard General Conditions)

The Schedule set forth below lists all Contract Drawings for the Project.

PHASE A:

G-000	COVER SHEET
G-001	PHASE A DRAWING LIST
G-003	RENDERING - AERIAL VIEW
G-005	GENERAL CONSTRUCTION NOTES
G-006	ABBREVIATIONS AND LOCATION PLANS
G-007	SYMBOLS, LEGENDS AND TYPICAL MOUNTING HEIGHTS
G-010	PROJECT BOUNDARY
G-020	SITE PLAN - WEST
G-021	SITE PLAN - EAST
G-030	EXISTING CONDITIONS - WEST
G-031	EXISTING CONDITIONS - EAST
G-032	SITE LOGISTICS PLAN BY LIRO CONSTRUCTION AUGUST 29, 2017
G-033	TEMPORARY SECURITY BARRIER
G-035	FINAL SITE CONDITIONS
G-036	TEMPORARY POWER FOR IRRIGATION PUMP
G-037	TEMPORARY IRRAGATION PUMP POWER DETAILS
G-050	BORING LOG - WEST
G-051	BORING LOG - EAST
G-052.0	GEOTECHNICAL DESIGN FOR REFERENCE – COVER SHEET
G-052.1	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 1 OF 13
G-052.2	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 2 OF 13
G-052.3	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 3 OF 13
G-052.4	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 4 OF 13
G-052.5	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 5 OF 13
G-052.6	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 6 OF 13
G-052.7	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 7 OF 13
G-052.8	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 8 OF 13
G-052.9	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 9 OF 13

G-053.0	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 10 OF 13
G-053.1	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 11 OF 13
G-053.2	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 12 OF 13
G-053.3	GEOTECHNICAL DESIGN FOR REFERENCE – PAGE 13 OF 13
G-058.0	TOPOGRAPHICAL MAP 1 OF 7
G-058.1	TOPOGRAPHICAL MAP 2 OF 7
G-058.2	TOPOGRAPHICAL MAP 3 OF 7
G-058.3	TOPOGRAPHICAL MAP 4 OF 7
G-058.4	TOPOGRAPHICAL MAP 5 OF 7
G-058.5	TOPOGRAPHICAL MAP 6 OF 7
G-058.6	TOPOGRAPHICAL MAP 7 OF 7
L-000	LANDSCAPE COVER SHEET
L-001	LANDSCAPE AND IRRIGATION GENERAL NOTES & MASTER LEGEND
L-100	DEMOLITION & REMOVALS PLAN SHEET 1
L-101	DEMOLITION & REMOVALS PLAN SHEET 2
L-102	DEMOLITION & REMOVALS PLAN SHEET 3
L-104	DEMOLITION & REMOVALS PLAN STAGING AND TREE REMOVAL AREA
L-110	TREE PROTECTION PLAN- WEST
L-111	TREE PROTECTION PLAN- SOUTH
L-112	TREE PROTECTION PLAN: ENLARGEMENT SOUTHEAST
L-114	EXISTING TREE INVENTORY LISTS
L-115	EXISTING TREE REMOVAL INVENTORY LISTS
L-119	WALL KEY PLAN
L-120	SITE MATERIALS PLAN WEST
L-121	SITE MATERIALS PLAN SOUTH
L-122	SITE MATERIALS PLAN SOUTHEAST
L-130	SITE GRADING PLAN WEST
L-131	SITE GRADING PLAN SOUTH
L-132	SITE GRADING PLAN SOUTHEAST
L-140	LAYOUT PLAN WEST
L-141	LAYOUT PLAN SOUTH
L-142	LAYOUT PLAN SOUTHEAST
L-160	SITE PLANTING SOILS PLAN WEST
L-161	SITE PLANTING SOILS PLAN SOUTH

L-162	SITE PLANTING SOILS PLAN SOUTHEAST
L-170	TREE PLANTING PLAN WEST
L-171	TREE PLANTING PLAN SOUTH
L-172	TREE PLANTING PLAN SOUTHEAST
L-174	UNDERSTORY PLANTING PLAN WEST
L-175	UNDERSTORY PLANTING PLAN SOUTH
L-176	UNDERSTORY PLANTING PLAN SOUTHEAST
L-179	UNDERSTORY PLANTING PLAN ENLARGEMENT CELLS 1 & 2
L-180	UNDERSTORY PLANTING PLAN ENLARGEMENT CELLS 3 & 4
L-187	UNDERSTORY PLANTING LISTS
L-188	UNDERSTORY PLANTING LISTS
L-189	UNDERSTORY PLANTING LISTS
L-190	TREE PLANTING LAYOUTS PLAN WEST
L-191	TREE PLANTING LAYOUTS PLAN SOUTH
L-192	TREE PLANTING LAYOUTS PLAN SOUTHWEST
L-200	IRRIGATION PLAN (1 of 5)
L-201	IRRIGATION PLAN (2 of 5)
L-202	IRRIGATION PLAN (3 of 5)
L-203	IRRIGATION PLAN (4 of 5)
L-204	IRRIGATION PLAN (5 of 5)
L-304	LANDSCAPE SITE WALL ELEVATION - WALL 16
L-310	WETLAND CELL SITE SECTIONS
L-311	WETLAND CELL SITE SECTIONS
L-312	WETLAND CELL SITE SECTIONS
L-313	WETLAND CELL SITE SECTIONS
L-320	LANDSCAPE SITE WALL SECTIONS - WALL 16
L-400	PAVING DETAILS
L-403	CURBS, HEADERS, & STEEL EDGING DETAILS
L-405	ROCKERY DETAILS
L-406	INTERDICTION BOULDER BARRIER
L-410	WATER SUPPLY TROUGH DETAILS
L-411	WATER SUPPLY TROUGH DETAILS
L-412	WETLAND LINER DETAILS

L-413	BOULDERY TYPE AND KEY PLAN
L-414	BOULDERY LAYOUT
L-415	BOULDERY LAYOUT
L-416	BOULDERY LAYOUT
L-421	GABION WALL DETAILS
L-422	LEVEL CONCRETE WEIR WALL AND FOREBAY DETAILS
L-423	WEIR DETAILS
L-424	VARIED HEIGHT CONCRETE WEIR WALL DETAILS
L-427	WALL JUNCTION DETAILS
L-441	SITE FURNITURE DETAILS: BENCH
L-460	TREE PROTECTION DETAILS
L-461	SITE PLANTING DETAILS ON GRADE
L-462	WETLAND DETAILS
L-465	WILDLIFE EXCLUSION BARRIER DETAILS
L-467	IRRIGATION DETAILS

C-001	CIVIL ABBREVIATIONS AND NOTES
C-002	CIVIL PROPOSED SITE CONDITIONS - OVERALL PLAN
C-100	EROSION & SEDIMENT CONTROL PLAN - SHEET 1
C-101	EROSION & SEDIMENT CONTROL PLAN - SHEET 2
C-102	EROSION & SEDIMENT CONTROL PLAN - SHEET 3
C-105	REMOVALS AND DEMOLITION - SHEET 1
C-106	REMOVALS AND DEMOLITION - SHEET 2
C-107	REMOVALS AND DEMOLITION - SHEET 3
C-200	WATER RE-USE PLAN - SHEET 1
C-201	WATER RE-USE PLAN - SHEET 2
C-202	WATER RE-USE PLAN - SHEET 3
C-500	DETAILS I
C-504	DETAILS V

A-630	CART PATH FENCE LAYOUT
A-631	CART PATH FENCE DETAILS
A-632	CART PATH FENCE DETAILS

S-000	STRUCTURAL GENERAL NOTES

S-001	STRUCTURAL GENERAL NOTES
S-002	STRUCTURAL GENERAL NOTES
S-800	FOUNDATION DRAWINGS
S-801	NETTING POLE PLAN AND ELEVATIONS
S-802	NETTING POLE DETAILS

PHASE B – VOLUME1:

G-000	PROJECT PHASE COVER SHEET
G-001	PHASE B DRAWING LIST- VOLUME 1
G-002	PHASE B DRAWING LIST- VOLUME 2
G-003	RENDERING - AERIAL VIEW
G-004	RENDERING - FRONT VIEW
G-005	GENERAL NOTES
G-006	ABBREVIATIONS AND LOCATION PLAN
G-007	SYMBOLS, LEGENDS AND TYPICAL MOUNTING HEIGHTS
G-008	ACCESSIBILITY & ADAPTABILITY NOTES
G-010	PROJECT BOUNDARY
G-020	SITE PLAN - WEST
G-021	SITE PLAN - EAST
G-030	EXISTING CONDITIONS - WEST
G-031	EXISTING CONDITIONS - EAST
G-032	LOGISTICS AND SITE SECURITY PLAN
G-033	TEMPORARY SECURITY BARRIER
G-035	FINAL SITE CONDITIONS
G-036	TEMPORARY POWER FOR IRRGATION PUMP
G-037	TEMPORARY IRRIGATION PUMP POWER DETAILS
G-050	BORING LOG - WEST
G-051	BORING LOG - EAST
G-052.0	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – COVER SHEET
G-052.1	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 1 OF 13
G-052.2	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 2 OF 13
G-052.3	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 3 OF 13
G-052.4	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 4 OF 13
G-052.5	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 5 OF 13
G-052.6	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 6 OF 13

G-052.7	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 7 OF 13
G-052.8	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 8 OF 13
G-052.9	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 9 OF 13
G-053.0	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 10 OF 13
G-053.1	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 11 OF 13
G-053.2	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 12 OF 13
G-053.3	GEOTECHNICAL DESIGN REPORT FOR REFERENCE – PAGE 13 OF 13
G-054	RECORD OF BORINGS SHEET 1 OF 3
G-055	RECORD OF BORINGS SHEET 2 OF 3
G-056	RECORD OF BORINGS SHEET 3 OF 3
G-057	BORING LOCATIONS COORDINATES
G-058.0	TOPOGRAPHICAL MAP 1 OF 7
G-058.1	TOPOGRAPHICAL MAP 2 OF 7
G-058.2	TOPOGRAPHICAL MAP 3 OF 7
G-058.3	TOPOGRAPHICAL MAP 4 OF 7
G-058.4	TOPOGRAPHICAL MAP 5 OF 7
G-058.5	TOPOGRAPHICAL MAP 6 OF 7
G-058.6	TOPOGRAPHICAL MAP 7 OF 7
G-060	CLUBHOUSE GEOMETRY SETTING OUT - BASEMENT
G-061	CLUBHOUSE GEOMETRY SETTING OUT - FIRST FLOOR
G-062	CLUBHOUSE GEOMETRY SETTING OUT - ROOF

L-000	LANDSCAPE COVER SHEET
L-001	LANDSCAPE AND IRRIGATION GENERAL NOTES & MASTER LEGEND
L-102	DEMOLITION & REMOVALS PLAN SHEET 3
L-103	DEMOLITION & REMOVALS PLAN SHEET 4
L-104	DEMOLITION & REMOVALS PLAN – STAGING + TREE REMOVALS
L-112	TREE PROTECTION PLAN - SOUTHEAST
L-113	TREE PROTECTION PLAN - EAST
L-114	EXISTING TREE INVENTORY LISTS
L-115	EXISTING TREE REMOVAL LIST
L-119	WALL KEY PLAN
L-122	SITE MATERIALS PLAN SOUTHEAST
L-123	SITE MATERIALS PLAN EAST
L-124	SITE MATERIALS PLAN CLUBHOUSE ROOF
L-125	SITE MATERIALS PLAN CLUBHOUSE ROOF

L-126	SITE MATERIALS PLAN SOUTHEAST ENLARGEMENT
L-127	SITE MATERIALS PLAN SOUTHEAST ENLARGEMENT
L-128	SITE MATERIALS PLAN SOUTHEAST ENLARGEMENT
L-129	SITE MATERIALS PLAN SOUTHEAST ENLARGEMENT
L-132	SITE GRADING PLAN SOUTHEAST
L-133	SITE GRADING PLAN EAST
L-134	GRADING PLAN: CLUBHOUSE ROOF
L-135	GRADING PLAN: CLUBHOUSE ROOF
L-136	GRADING PLAN: CLUBHOUSE ROOF
L-137	SITE GRADING PLAN ENLARGEMENT
L-138	SITE GRADING PLAN ENLARGEMENT
L-142	LAYOUT PLAN SOUTHEAST
L-143	LAYOUT PLAN WEST
L-144	LAYOUT PLAN CLUBHOUSE ROOF
L-145	LAYOUT PLAN CLUBHOUSE ROOF
L-146	LAYOUT PLAN CLUBHOUSE ROOF
L-147	LAYOUT PLAN ENLARGEMENT
L-148	LAYOUT PLAN ENLARGEMENT
L-149	LAYOUT PLAN ENLARGEMENT
L-150	LAYOUT PLAN ENLARGEMENT
L-151	LAYOUT PLAN ENLARGEMENT
L-152	LAYOUT PLAN ENLARGEMENT
L-153	LAYOUT PLAN ENLARGEMENT - CLUBHOUSE ROOF
L-162	SITE PLANTING SOILS PLAN SOUTHWEST
L-163	SITE PLANTING SOILS PLAN SOUTHEAST
L-164	SOILS PLAN CLUBHOUSE ROOF
L-172	TREE PLANTING PLAN SOUTHEAST
L-173	TREE PLANTING PLAN EAST
L-176	UNDERSTORY PLANTING PLAN SOUTHEAST
L-177	UNDERSTORY PLANTING PLAN EAST
L-178	PLANTING PLAN CLUBHOUSE ROOF
L-182	UNDERSTORY PLANTING PLAN SOUTHEAST
L-183	UNDERSTORY PLANTING PLAN SOUTHEAST
L-184	UNDERSTORY PLANTING PLAN SOUTHEAST

L-185	UNDERSTORY PLANTING PLAN SOUTHEAST
L-186	UNDERSTORY PLANTING PLAN SOUTHEAST
L-187	UNDERSTORY PLANTING LISTS
L-188	UNDERSTORY PLANTING LISTS
L-192	TREE PLANTING COORDINATES PLAN SOUTHWEST
L-193	TREE PLANTING LAYOUT PLAN SOUTHEAST
L-204	IRRIGATION PLAN
L-205	IRRIGATION PLAN
L-206	IRRIGATION PLAN
L-207	IRRIGATION PLAN
L-208	IRRIGATION PLAN
L-210	SITE LIGHTING PLAN SOUTHEAST
L-211	SITE LIGHTING PLAN EAST
L-220	IRRIGATION PLAN GREEN ROOF (1 of 3)
L-221	IRRIGATION PLAN GREEN ROOF (2 of 3)
L-222	IRRIGATION PLAN GREEN ROOF (3 of 3)
L-300	LANDSCAPE SITE SECTION AT PLAZA 1
L-301	LANDSCAPE SITE SECTION AT PLAZA 2
L-302	LANDSCAPE SITE SECTION: DPR PARKING LOT TURNAROUND
L-303	LANDSCAPE SITE ELEVATION - JEROME AVENUE
L-305	LANDSCAPE SITE WALL ELEVATION - WALLS 17A, 17B, 17C, 17D
L-306	LANDSCAPE SITE WALL ELEVATION - WALLS 19,20,38
L-314	WETLAND CELL SITE SECTIONS
L-322	LANDSCAPE SITE WALL SECTIONS - WALL 38
L-400	PAVING DETAILS
L-401	PLANK PAVING DETAILS
L-402	PAVING DETAILS
L-403	CURBS, HEADERS, & STEEL EDGING DETAILS
L-404	RAMPS & DROP CURB LAYOUT DETAILS
L-405	BOULDER DETAILS
L-412	WETLAND LINER DETAILS
L-413	BOULDER TYPE AND KEY PLAN
L-417	BOULDER LAYOUT

L-418	BOULDER LAYOUT
L-419	BOULDER LAYOUT
L-421	GABION WALL DETAILS
L-422	LEVEL CONCRETE WEIR WALL AND FOREBAY DETAILS
L-423	WEIR DETAILS
L-425	CELL 6 WALL DETAILS
L-427	WALL JUNCTION DETAILS
L-428	FENCE DETAILS
L-431	PARKING/ACCESS CONTROL AT CLUBHOUSE PARKING LOT
L-432	PARKING ACCESS CONTROL
L-436	RAILING AT CELL 6 OVERLOOK
L-440	SITE FURNITURE DETAILS: FLAGPOLE & BIKE RACK & BOLLARD
L-441	SITE FURNITURE DETALS: BENCH
L-460	TREE PROTECTION DETAILS
L-461	SITE PLANTING DETAILS ON GRADE
L-463	CLUBHOUSE GREEN ROOF SITE SECTIONS & DETAILS
L-464	CLUBHOUSE GREEN ROOF SITE SECTIONS & DETAILS
L-466	IRRIGATION PUMP HOUSE PLANS
L-467	IRRIGATION DETAILS
L-468	IRRIGATION DETAILS
L-480	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-481	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-482	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-483	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-484	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-485	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-486	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-487	CLUBHOUSE ROOF PLANTING PLAN ENLARGEMENT
L-490	LIGHTING INSTALLATION DETAILS
L-491	LIGHTING INSTALLATION DETAILS
L-492	LIGHTING INSTALLATION DETAILS
C-001	CIVIL ABBREVIATIONS AND NOTES
C-002	CIVIL PROPOSED SITE CONDITIONS - OVERALL PLAN
C-102	EROSION CONTROL PLAN
C-103	EROSION CONTROL PLAN

C-107	REMOVALS AND DEMOLITION
C-108	REMOVALS AND DEMOLITION
C-112	STORM DRAINAGE PLAN - SHEET 1
C-113	STORM DRAINAGE PLAN - SHEET 2
C-122	SANITARY SEWER PLAN - SHEET 1
C-132	UTILITY PLAN - SHEET 1
C-133	UTILITY PLAN - SHEET 2
C-202	WATER RE-USE PLAN
C-302	BUILDERS PAVEMENT PLAN
C-303	BUILDERS PAVEMENT PLAN
C-400	SANITARY SEWER PROFILES
C-401	STORM SEWER PROFILES
C-404	STORM SEWER PROFILES
C-500	DETAILS I
C-501	DETAILS II
C-502	DETAILS III
C-503	DETAILS IV
C-504	DETAILS V
C-505	DETAILS VI
C-507	DETAILS VIII - SEQUENCING PLAN
A-001	BASEMENT KEY PLAN
A-002	FIRST FLOOR KEY PLAN
A-003	ROOF KEY PLAN
A-010	EAST ELEVATION (UNFOLDED)
A-011	WEST ELEVATION (UNFOLDED)
A-020	LONGITUDINAL SECTION (UNFOLDED)
A-030	LIFE SAFETY ANALYSIS
A-031	LIFE SAFETY PLANS - BASEMENT & FIRST FLOOR
A-032	LIFE SAFETY PLANS - ROOF

A-050	SLAB LAYOUT - FIRST FLOOR (1 of 2)
A-051	SLAB LAYOUT - FIRST FLOOR (2 of 2)
A-102	ENLARGED BASEMENT PLAN (1 of 8)
A-103	ENLARGED BASEMENT PLAN (2 of 8)
A-104	ENLARGED BASEMENT PLAN (3 of 8)
A-105	ENLARGED BASEMENT PLAN (4 of 8)
A-106	ENLARGED BASEMENT PLAN (5 of 8)
A-107	ENLARGED BASEMENT PLAN (6 of 8)
A-108	ENLARGED BASEMENT PLAN (7 of 8)
A-109	ENLARGED BASEMENT PLAN (8 of 8)
A-110	ENLARGED FIRST FLOOR PLAN (1 of 7)
A-111	ENLARGED FIRST FLOOR PLAN (2 of 7)
A-112	ENLARGED FIRST FLOOR PLAN (3 of 7)
A-113	ENLARGED FIRST FLOOR PLAN (4 of 7)
A-114	ENLARGED FIRST FLOOR PLAN (5 of 7)
A-115	ENLARGED FIRST FLOOR PLAN (6 of 7)
A-119	ENLARGED FIRST FLOOR PLAN (7 of 7)
A-120	ENLARGED ROOF PLAN (1 of 9)
A-121	ENLARGED ROOF PLAN (2 of 9)
A-122	ENLARGED ROOF PLAN (3 of 9)
A-123	ENLARGED ROOF PLAN (4 of 9)
A-124	ENLARGED ROOF PLAN (5 of 9)
A-125	ENLARGED ROOF PLAN (6 of 9)
A-126	ENLARGED ROOF PLAN (7 of 9)
A-127	ENLARGED ROOF PLAN (8 of 9)
A-128	ENLARGED ROOF PLAN (9 of 9)
A-132	BASEMENT REFLECTED CEILING PLAN (1 of 7)
A-133	BASEMENT REFLECTED CEILING PLAN (2 of 7)
A-134	BASEMENT REFLECTED CEILING PLAN (3 of 7)
A-135	BASEMENT REFLECTED CEILING PLAN (4 of 7)
A-136	BASEMENT REFLECTED CEILING PLAN (5 of 7)
A-137	BASEMENT REFLECTED CEILING PLAN (6 of 7)
A-138	BASEMENT REFLECTED CEILING PLAN (7 of 7)
A-140	FIRST FLOOR REFLECTED CEILING PLAN (1 of 9)
A-141	FIRST FLOOR REFLECTED CEILING PLAN (2 of 9)
A-142	FIRST FLOOR REFLECTED CEILING PLAN (3 of 9)

A-143	FIRST FLOOR REFLECTED CEILING PLAN (4 of 9)
A-144	FIRST FLOOR REFLECTED CEILING PLAN (5 of 9)
A-145	FIRST FLOOR REFLECTED CEILING PLAN (6 of 9)
A-146	FIRST FLOOR REFLECTED CEILING PLAN (7 of 9)
A-147	FIRST FLOOR REFLECTED CEILING PLAN (8 of 9)
A-148	FIRST FLOOR REFLECTED CEILING PLAN (9 of 9)
A-150	FIRST FLOOR FINISHES PLAN (1 of 4)
A-151	FIRST FLOOR FINISHES PLAN (2 of 4)
A-152	FIRST FLOOR FINISHES PLAN (3 of 4)
A-153	FIRST FLOOR FINISHES PLAN (4 of 4)
A-200	ENLARGED EAST ELEVATION (UNFOLDED) - (1 of 8)
A-201	ENLARGED EAST ELEVATION (UNFOLDED) - (2 of 8)
A-202	ENLARGED EAST ELEVATION (UNFOLDED) - (3 of 8)
A-203	ENLARGED EAST ELEVATION (UNFOLDED) - (4 of 8)
A-204	ENLARGED EAST ELEVATION (UNFOLDED) - (5 of 8)
A-205	ENLARGED EAST ELEVATION (UNFOLDED) - (6 of 8)
A-206	ENLARGED EAST ELEVATION (UNFOLDED) - (7 of 8)
A-207	ENLARGED EAST ELEVATION (UNFOLDED) - (8 of 8)
A-208	ENLARGED NORTH ELEVATION
A-209	ENLARGED WEST ELEVATION (UNFOLDED) - (1 of 8)
A-210	ENLARGED WEST ELEVATION (UNFOLDED) - (2 of 8)
A-211	ENLARGED WEST ELEVATION (UNFOLDED) - (3 of 8)
A-212	ENLARGED WEST ELEVATION (UNFOLDED) - (4 of 8)
A-213	ENLARGED WEST ELEVATION (UNFOLDED) - (5 of 8)
A-214	ENLARGED WEST ELEVATION (UNFOLDED) - (6 of 8)
A-215	ENLARGED WEST ELEVATION (UNFOLDED) - (7 of 8)
A-216	ENLARGED WEST ELEVATION (UNFOLDED) - (8 of 8)
A-217	ENLARGED SOUTH ELEVATION
A-218	STONE WALL TYPES - ELEVATIONS
A-300	ENLARGED BUILDING SECTION
A-301	ENLARGED BUILDING SECTION
A-302	ENLARGED BUILDING SECTION
A-303	ENLARGED BUILDING SECTION THROUGH OFFICE
A-304	ENLARGED BUILDING SECTION THROUGH CORRIDOR
A-305	ENLARGED BUILDING SECTION THROUGH LOCKER ROOM / TEE BOX
A-306	ENLARGED BUILDING SECTION THROUGH CART STORAGE / TEE BOX
A-307	ENLARGED BUILDING SECTION THROUGH DEP PUMP ROOM / TEE BOX
A-308	ENLARGED BUILDING SECTION THROUGH TEE BOX

A-309	ENLARGED BUILDING SECTION AT BASEMENT ENTRANCE
A-310	ENLARGED BUILDING SECTION THROUGH TEE BOX
A-400	INTERIOR ELEVATIONS
A-401	INTERIOR ELEVATIONS
A-402	INTERIOR ELEVATIONS - BATHROOMS
A-600	POD ENLARGED PLAN
A-601	POD ENLARGED RCP
A-602	POD ELEVATIONS AND SECTIONS
A-603	POD ELEVATIONS AND SECTIONS
A-604	POD INTERIOR ELEVATIONS
A-605	POD MILLWORK DETAILS
A-606	POD MILLWORK DETAILS
A-607	POD PLAN DETAILS
A-608	WOOD SLAT DETAILS
A-609	POD KITCHEN INTERIOR ELEVATIONS
A-610	TEE BOX CANOPY SYSTEM DRAWING
A-611	TEE BOX LIGHT POLE SYSTEM DRAWING
A-613	TEE BOX GEOMETRY DRAWING
A-614	TEE BOX PRECAST DETAILS
A-615	TEE BOX CONCRETE DETAILS
A-616	TEE BOX STEEL DETAILS
A-617	TEE BOX FABRIC DETAILS
A-618	TEE BOX DIVIDER
A-619	TEE BOX FALL SAFE SHELF
A-620	TEE BOX ACCESSORIES
A-635	WATER FEATURE SYSTEM DRAWING
A-640	BRIDGE AT DRIVING RANGE BRIDGE
A-641	WETLAND CELL PUMP ROOM - WET WELL SECTION & PLAN
A-642	IRRIGATION PUMP ROOM - WET WELL SECTION & PLAN
A-643	WATER FEATURE PUMP ROOM - PUMP ROOM SECTION & PLAN
A-650	STAIR #1 ELEVATION AND SECTION
A-651	STAIR #1 DETAILS
A-652	STAIR #2 SECTIONS & DETAILS
A-653	STAIR #3 ELEVATIONS AND SECTIONS

A-654	STAIR #5 SECTION, & ELEVATION
A-655	STAIR #5 SECTION, & ELEVATION
A-656	STAIR #6 PLAN, SECTION, & ELEVATION
A-657	RAMP #1 SECTIONS & DETAILS
A-662	WOOD CEILING PANEL TYPES
A-664	GFRC EAVE PANEL TYPES
A-665	GFRC EAVE PANEL TYPES - CONT
A-750	CURTAIN WALL AND CLERESTORY GLAZING GEOMETRY
A-751	WALL SECTIONS THROUGH CURTAINWALL
A-752	WALL SECTIONS THROUGH SOUTH CURTAIN WALL
A-753	WALL SECTIONS THROUGH EXTERIOR STONE CLADDING
A-810	EAST & WEST FACADE GLAZING DETAILS
A-811	EAST & WEST FACADE GLAZING DETAILS
A-812	SOUTH FACADE GLAZING DETAILS
A-813	SOUTH FACADE GLASS VESTIBULE DETAILS
A-814	MISC CURTAIN WALL DETAILS
A-815	TYPICAL FIN TUBE TRENCH SECTION DETAILS
A-816	VEST. #2 CURTAIN WALL DETAILS
A-817	TYPICAL SECTION DETAILS
A-818	TAPERED STEEL COLUMN DETAILS
A-820	TYPICAL STONE SECTION DETAILS
A-821	TYPICAL STONE SECTION DETAILS
A-822	EXTERIOR STONE CLADDING DETAILS
A-830	TYPICAL ROOF DETAILS
A-842	PLAN DETAILS
A-843	PLAN DETAILS
A-844	PLAN DETAILS
A-845	CLUBHOUSE GATE DETAILS
A-846	MILLWORK DETAILS
A-847	MISC DETAILS
A-865	TYPICAL CEILING DETAILS
A-866	CEILING DETAILS
A-881	SECURITY GATE DETAILS

A-882	ENTRANCE GATE
A-883	ENTRANCE GATE DETAILS
A-887	GUARD RAIL TYPES AND DETAILS
A-888	GUARD RAIL DETAILS
A-900	WALL PARTITION TYPES
A-901	WALL PARTITION TYPES
A-902	PARTITION DETAILS
A-930	DOOR SCHEDULE AND TYPES
A-940	CURTAIN WALL TYPES
A-941	LOUVER TYPES
A-950	ROOM FINISH/ EQUIPMENT SCHEDULE

PHASE B - VOLUME2:

S-000	STRUCTURAL GENERAL NOTES
S-001	STRUCTURAL GENERAL NOTES
S-002	STRUCTURAL GENERAL NOTES
S-090	DPR CLUBHOUSE FOUNDATION PLAN -1
S-091	DPR CLUBHOUSE FOUNDATION PLAN -2
S-092	DPR CLUBHOUSE FOUNDATION PLAN -3
S-093	DPR CLUBHOUSE FOUNDATION PLAN -4
S-094	DPR CLUBHOUSE FOUNDATION PLAN -5
S-095	DPR CLUBHOUSE FOUNDATION PLAN -6
S-096	DPR CLUBHOUSE FOUNDATION PLAN -7
S-097	DPR CLUBHOUSE FOUNDATION PLAN -8
S-098	DPR CLUBHOUSE FOUNDATION PLAN -9
S-100	DPR CLUBHOUSE BASEMENT PLAN -1
S-101	DPR CLUBHOUSE BASEMENT PLAN -2
S-102	DPR CLUBHOUSE BASEMENT PLAN -3
S-103	DPR CLUBHOUSE BASEMENT PLAN -4
S-104	DPR CLUBHOUSE BASEMENT PLAN -5
S-105	DPR CLUBHOUSE BASEMENT PLAN -6
S-106	DPR CLUBHOUSE BASEMENT PLAN -7
S-107	DPR CLUBHOUSE BASEMENT PLAN -8
S-108	DPR CLUBHOUSE BASEMENT PLAN -9

S-110	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -1
S-111	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -2
S-112	DPR CLUBHOUSE MAIL FLOOR FRAMING PLAN -3
S-113	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -4
S-114	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -5
S-115	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -6
S-116	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -7
S-117	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -8
S-118	DPR CLUBHOUSE MAIN FLOOR FRAMING PLAN -9
S-120	DPR CLUBHOUSE ROOF FRAMING PLAN -1
S-121	DPR CLUBHOUSE ROOF FRAMING PLAN -2
S-122	DPR CLUBHOUSE ROOF FRAMING PLAN -3
S-123	DPR CLUBHOUSE ROOF FRAMING PLAN -4
S-124	DPR CLUBHOUSE ROOF FRAMING PLAN -5
S-125	DPR CLUBHOUSE ROOF FRAMING PLAN -6
S-126	DPR CLUBHOUSE ROOF FRAMING PLAN -7
S-127	DPR CLUBHOUSE ROOF FRAMING PLAN -8
S-128	DPR CLUBHOUSE ROOF FRAMING PLAN -9
S-300	STRUCTURAL SECTION
S-301	STRUCTURAL SECTION
S-302	STRUCTURAL SECTION
S-303	STRUCTURAL SECTION
S-304	STRUCTURAL SECTION
S-305	STRUCTURAL SECTION
S-306	STRUCTURAL SECTION
S-307	STRUCTURAL SECTION
S-308	STRUCTURAL SECTION
S-309	STRUCTURAL SECTION
S-310	UNFOLDED WALL ELEVATION I
S-311	UNFOLDED WALL ELEVATION II
S-312	UNFOLDED WALL ELEVATION III
S-313	UNFOLDED WALL ELEVATION IV
S-314	UNFOLDED WALL ELEVATION V
S-320	WATER FEATURE PUMP ROOM SECTIONS AND PLAN
S-350	COLUMN SCHEDULE I
S-351	COLUMN SCHEDULE II
S-400	TYPICAL CONCRETE DETAILS
S-401	TYPICAL CONCRETE DETAILS

S-402	TYPICAL CONCRETE DETAILS
S-403	TYPICAL CONCRETE DETAILS
S-404	TYPICAL FOUNDATION DETAILS
S-405	TYPICAL FOUNDATION DETAILS
S-406	TYPICAL CONCRETE SLAB DETAILS
S-407	TYPICAL CONCRETE WALL DETAILS
S-408	TYPICAL CONCRETE WALL DETAILS
S-409	TYPICAL RETAINING WALL DETAILS
S-410	TYPICAL CONCRETE COLUMN DETAILS
S-420	CONCRETE SECTIONS AND DETAILS
S-421	CONCRETE SECTIONS AND DETAILS
S-423	CONCRETE SECTIONS AND DETAILS
S-424	TYPICAL CMU WALL DETAILS
S-430	TYPICAL SIGNAGE DETAILS
S-500	TYPICAL CONCRETE SECTIONS AND DETAILS
S-501	TYPICAL STEEL BEAM DETAILS
S-502	TYPICAL STEEL COLUMN DETAILS
S-503	TYPICAL STEEL DECK DETAILS
S-504	TYPICAL STEEL DECK DETAILS
S-510	STEEL SECTIONS AND DETAILS
S-511	STEEL SECTIONS AND DETAILS
S-512	STEEL SECTIONS AND DETAILS
S-513	STEEL SECTIONS AND DETAILS
S-514	STEEL SECTIONS AND DETAILS
S-520	STAIR #1 SECTIONS AND DETAILS
S-600	TEE BOX PLAN AND ELEVATION
S-601	TEE BOX PLAN AND ELEVATION
S-602	TEE BOX PLAN AND ELEVATION
S-603	TEE BOX PLAN AND ELEVATION
S-700	TEE BOX SECTIONS AND DETAILS
S-701	TEE BOX SECTIONS AND DETAILS
S-702	PRECAST CONCRETE DETAILS
S-703	PRECAST CONCRETE DETAILS

M-001	MECHANICAL LEGEND
M-002	MECHANICAL NOTES
M-102	BASEMENT DUCT AND PIPING PLAN
M-103	BASEMENT DUCT AND PIPING PLAN
M-110	FIRST FLOOR DUCTWORK PLAN (1 of 4)
M-111	FIRST FLOOR DUCTWORK PLAN (2 of 4)
M-112	FIRST FLOOR DUCTWORK PLAN (3 of 4)
M-113	FIRST FLOOR DUCTWORK PLAN (4 of 4)
M-121	ROOF DUCTWORK PLAN
M-210	FIRST FLOOR PIPING PLAN (1 of 4)
M-211	FIRST FLOOR PIPING PLAN (2 of 4)
M-212	FIRST FLOOR PIPING PLAN (3 of 4)
M-213	FIRST FLOOR PIPING PLAN (4 of 4)
M-500	HVAC DETAILS (1 of 3)
M-501	HVAC DETAILS (2 of 3)
M-502	HVAC DETAILS (3 of 3)
M-600	HVAC SCHEDULE
M-601	HVAC SCHEDULE
M-700	DUAL TEMPERATURE RISER DIAGRAM
M-701	AIR FLOW RISER DIAGRAMS
M-702	FREE COOLING WATER RISER DIAGRAMS
M-800	CONTROLS DIAGRAMS
M-900	TEE BOX EQUIPMENT PLAN
E-001	ELECTRICAL SYMBOL LIST
E-002	ELECTRICAL NOTES
E-102	BASEMENT POWER PLAN
E-103	BASEMENT POWER PLAN
E-108	BASEMENT POWER PLAN
E-110	1ST FLOOR POWER PLAN
E-111	1ST FLOOR POWER PLAN

E-112	1ST FLOOR POWER PLAN
E-113	1ST FLOOR POWER PLAN
E-114	1ST FLOOR POWER PLAN
E-115	1ST FLOOR POWER PLAN
E-120	ROOF POWER PLAN
E-202	BASEMENTLIGHTING PLAN
E-203	BASEMENTLIGHTING PLAN
E-204	BASEMENTLIGHTING PLAN
E-205	BASEMENTLIGHTING PLAN
E-206	BASEMENTLIGHTING PLAN
E-207	BASEMENTLIGHTING PLAN
E-208	BASEMENTLIGHTING PLAN
E-209	BASEMENTLIGHTING PLAN
E-210	1ST FLOOR LIGHTING PLAN
E-211	1ST FLOOR LIGHTING PLAN
E-212	1ST FLOOR LIGHTING PLAN
E-213	1ST FLOOR LIGHTING PLAN
E-214	1ST FLOOR LIGHTING PLAN
E-215	1ST FLOOR LIGHTING PLAN
E-216	1ST FLOOR LIGHTING PLAN
E-217	1ST FLOOR LIGHTING PLAN
E-218	1ST FLOOR LIGHTING PLAN
E-219	1ST FLOOR LIGHTING PLAN
E-220	ROOF LIGHTING PLAN
E-221	ROOF LIGHTING PLAN
E-222	ROOF LIGHTING PLAN
E-223	ROOF LIGHTING PLAN
E-224	ROOF LIGHTING PLAN
E-225	ROOF LIGHTING PLAN
E-226	ROOF LIGHTING PLAN
E-227	ROOF LIGHTING PLAN
E-228	ROOF LIGHTING PLAN
E-300	SITE POWER PLAN
E-320	SITE LIGHTING PLAN (1 of 3)
E-321	SITE LIGHTING PLAN (2 of 3)

E-322	SITE LIGHTING PLAN (3 of 3)
E-600	PANEL SCHEDULES
E-601	PANEL SCHEDULES
E-602	PANEL SCHEDULES
E-603	PANEL SCHEDULES
E-700	ONE LINE DIAGRAMS
E-800	LIGHTING SCHEDULE
FA-001	FIRE ALARM SYMBOLS & RISER DIAGRAM
FA-102	BASEMENT FIRE ALARM PLAN
FA-103	BASEMENT FIRE ALARM PLAN
FA-110	FIRST FLOOR FIRE ALARM PLAN (1 of 1)
FA-111	FIRST FLOOR FIRE ALARM PLAN (1 of 2)
FA-112	FIRST FLOOR FIRE ALARM PLAN (1 of 3)
FA-113	FIRST FLOOR FIRE ALARM PLAN (1 of 4)
FA-120	ROOF FIRE ALARM PLAN (1 of 2)
FA-121	ROOF FIRE ALARM PLAN (2 of 9)
FA-122	ROOF FIRE ALARM PLAN (3 of 9)
FA-123	ROOF FIRE ALARM PLAN (4 of 9)
FA-124	ROOF FIRE ALARM PLAN (5 of 9)
FA-125	ROOF FIRE ALARM PLAN (6 of 9)
FA-126	ROOF FIRE ALARM PLAN (7 of 9)
FA-127	ROOF FIRE ALARM PLAN (8 of 9)
FA-128	ROOF FIRE ALARM PLAN (9 of 9)
P-001	PLUMBING SYMBOL LIST
P-100	BASEMENT PLUMBING PLAN (1 of 5)
P-101	BASEMENT PLUMBING PLAN (2 of 5)
P-102	BASEMENT PLUMBING PLAN (3 of 5)
PU-102	PLUMBING SYSTEMS - FOUNDATION PLAN
P-103	BASEMENT PLUMBING PLAN (4 of 5)
PU-103	PLUMBING SYSTEMS - FOUNDATION PLAN
P-108	BASEMENT PLUMBING PLAN (5 of 5)
PU-108	PLUMBING SYSTEMS - FOUNDATION PLAN
P-110	FIRST FLOOR PLUMBING PLAN (1 OF 9)

P-111	FIRST FLOOR PLUMBING PLAN (2 OF 9)
P-112	FIRST FLOOR PLUMBING PLAN (3 OF 9)
P-113	FIRST FLOOR PLUMBING PLAN (4 OF 9)
P-114	FIRST FLOOR PLUMBING PLAN (5 OF 9)
P-115	FIRST FLOOR PLUMBING PLAN (6 OF 9)
P-116	FIRST FLOOR PLUMBING PLAN (7 OF 9)
P-117	FIRST FLOOR PLUMBING PLAN (8 OF 9)
P-118	FIRST FLOOR PLUMBING PLAN (9 OF 9)
P-120	ROOF PLUMBING PLAN (1 of 9)
P-121	ROOF PLUMBING PLAN (2 of 9)
P-122	ROOF PLUMBING PLAN (3 of 9)
P-123	ROOF PLUMBING PLAN (4 of 9)
P-124	ROOF PLUMBING PLAN (5 of 9)
P-125	ROOF PLUMBING PLAN (6 of 9)
P-126	ROOF PLUMBING PLAN (7 of 9)
P-127	ROOF PLUMBING PLAN (8 of 9)
P-128	ROOF PLUMBING PLAN (9 of 9)
P-400	PLUMBING SYSTEMS - DPR CH FLOOR PART. PLANS
P-500	PLUMBING DETAILS
P-501	PLUMBING DETAILS
P-502	PLUMBING DETAILS
P-600	PLUMBING SCHEDULE
P-700	PLUMBING RISER DIAGRAMS
P-701	PLUMBING TEE BOX RISER DIAGRAMS
P-702	PLUMBING TEE BOX RISER DIAGRAMS
SP-001	FIRE PROTECTION SYMBOLS, NOTES, & ABBREVIATIONS
SP-102	BASEMENT SPRINKLER PLAN (2 of 3)
SP-103	BASEMENT SPRINKLER PLAN (3 of 3)
SP-110	1ST FLOOR SPRINKLER PLAN (1 of 4)
SP-111	1ST FLOOR SPRINKLER PLAN (2 of 4)
SP-112	1ST FLOOR SPRINKLER PLAN (3 of 4)
SP-113	1ST FLOOR SPRINKLER PLAN (4 of 4)

SP-500	FIRE PROTECTION TYPICAL DETAILS
SP-700	CH RISER DIAGRAM
SG1.01	DRAWING LIST
SG1.02	TYPE AND SYMBOLS
SG1.03	MATERIALS AND FINISHES
SG1.04	SIGN FAMILY (1 OF 2)
SG1.05	SIGN FAMILY (2 OF 2)
SG2.01	S1-ENTRANCE ID
SG2.02	S2-SITE ID
SG2.03	S2-SITE ID CONSTRUCTION DETAILS
SG2.04	S3-WAYFINDING SIGNAGE AT BUILDING ENTRANCE
SG2.05	S4-DOOR ID
SG2.06	S5–Pedestrian Wayfinding
SG2.06B	S5–Pedestrian Wayfinding Sign Face Layouts
SG2.07	S5–Pedestrian Wayfinding Construction Details
SG2.08	S7–Authorized Only
SG2.09	S8–DPR Concession Notice, A7–Hours of Operation
SG2.010	S9–Building Signage - Tee Box ID
SG2.011	S11–Interpretive Signs
SG2.011B	S11–Interpretive Signs Sign Face Layouts
SG2.12	S11–Interpretive Signs Construction Details
SG2.13	S10–Interpretive Map at Cell 6
SG2.14	S12–Interpretive Rail Sign at Cell 6
SG2.14B	S12–Interpretive Rail Sign at Cell 6 Sign Face Layouts
SG2.14C	S12–Interpretive Rail Sign at Cell 6 Sign Face Layouts
SG2.14D	S12–Interpretive Rail Sign at Cell 6 Sign Face Layouts
SG2.14E	S12–Interpretive Rail Sign at Cell 6 Sign Face Layouts
SG2.14F	S12–Interpretive Rail Sign at Cell 6 Sign Face Layouts
SG2.14G	S12–Interpretive Rail Sign at Cell 6 Sign Face Layouts
SG2.15	S12–Interpretive Rail Sign at Cell 6 Construction Details
SG2.16	A1–Office ID
SG2.17	A2–Tenant ID
SG2.18	A3–Special Room ID
SG2.19	A4–Service Room ID
SG2.20	A5–Pro Office Green Fees
SG2.21	A8–Digital Display

SG2.22	L1–LEED ID
SG2.23	L2–LEED Plaque
SG2.24	C1–Restroom ID
SG2.25	C2–Employee Hand Washing
SG2.26	C3–Stair ID Occupant Side
SG2.27	C4–Stair ID Stairwell
SG2.28	C5–Fire Extinguisher
SG2.29	C6–Maximum Occupancy
SG2.30	C7–Distraction Marking
SG2.31	C8–No Smoking Sign
SG2.32	C9–Restroom Flag ID
SG2.33	P1–Enter/Exit ID
SG2.33B	P1–Enter/Exit ID Sign Face Layouts
SG2.34	P1–Enter/Exit ID
SG2.35	P2–Vehicular Directional
SG2.36	P2–Vehicular Directional
SG2.37	P3–Accessible Parking ID, P5–Authorized Parking Only, P7–Low Emissions Vehicle Parking ID, P9-No Parking
SG2.38	P6–Parking Rates Information, P8–Parking Disclaimer
SG2.39	P6–Parking Rates Information, P8–Parking Disclaimer Construction Details
SG3.01	Site Plan
SG3.02	Basement Plan
SG3.03	First Floor Plan (1 of 2)
SG3.04	First Floor Plan (2 of 2)
SG3.05	Sign Message Schedule

SCHEDULE D

Electrical Motor Control Equipment

(Reference: 01 3506, Article 3.8 of the DDC Standard General Conditions)

Requirements for electrical motor equipment may be included in one or more sections of the Specifications for the Contract for the Project. Schedule D set forth below delineates specific information for electrical motor control equipment. In the event of any conflict between the Specifications and this Schedule D, Schedule D shall take precedence; provided, however, in the event of an omission from Schedule D (i.e., Schedule D omits either a reference to or information concerning electrical motor equipment which is set forth in the Specifications), such omission from Schedule D shall have no effect and the Contractor's obligation with respect to the electrical motor control equipment, as set forth in the Specifications, shall remain in full force and effect.

DB Disconnect Circuit Breaker (Switch)
TS Thermal Switch
MS Magnetic Starter
CMS Comb. Mag. Starter
P Pilot Light
F Firestat
T Thermostat
AL Alternator
BG Break Glass Station
HOA Hand-Off Auto.
PB Push Button Station
RO Remote "off"

Equip. Ident.	Location	# of Units	HP or KW	Volts and Phase	Control Type: See legend above	Remarks:
EF-1	Roof	1	1/2HP	208V/3PH	MS	
EF-2	First Floor	1	0.1KW	120V/1PH	MS	
EF-3	Basement	1	3/4HP	480V/3PH	MS	
EF-3	Basement	1	3/4HP	480V/3PH	MS	
ERV-1	First Floor	1	(2) 3/4HP	480V/3PH	HOA	
ERV-2	First Floor	1	(2) 3/4HP	480V/3PH	HOA	
ERV-4	Basement	1	(2) 2HP	480V/3PH	HOA	
ERV-5	Basement	1	(2) 5HP	480V/3PH	HOA	
ERV-6	Basement	1	(2) 3HP	480V/3PH	HOA	
ERV-7	Basement	1	(1) 3HP (1) 2HP	480V/3PH	HOA	
FCU-1	First Floor	1	3/4HP	208V/1PH	DB	
FCU-2	First Floor	1	1/3HP	208V/1PH	DB	
FCU-3	First Floor	1	1.5HP	208V/1PH	DB	
FCU-4	First Floor	1	1.5HP	208V/1PH	DB	
FCU-5	First Floor	1	1/3HP	208V/1PH	DB	
FCU-6	First Floor	1	3/4HP	208V/1PH	DB	
HP-1	First Floor	1	36kW	480V/3PH	DB	
HP-2	First Floor	1	36kW	480V/3PH	DB	
P-1	First Floor	1	1.5HP	480V/3PH	HOA	
P-2C	First Floor	1	1HP	480V/3PH	HOA	

P-2H	First Floor	1	1HP	480V/3PH	HOA	
P-4	Basement	1	5HP	480V/3PH	HOA	
P-5	First Floor	1	(2) 1/3HP	120V/1PH	HOA	
SF-1	First Floor	1	1/2HP	208V/1PH	DB	
TB-1	Basement	1	5HP	480V/3PH	DB	
FP-1	Basement	1	25HP	480V/3PH	HOA	
GB-1	Basement	1	1/2HP	208V/3PH	DB	
GW-1	Basement	2	5HP	480V/3PH	HOA	
HWRP-1	First Floor	1	1/6HP	120V/1PH	MS	
JP-1	Basement	1	2HP	480V/3PH	DB	
PUMP-1A	Basement	2	15HP	480V/3PH	HOA	
PUMP-1B	Basement	2	5HP	480V/3PH	HOA	
WFP-1	Basement	2	15HP	480V/3PH	HOA	
IRP-1	Basement	1	30	480V/3PH	HOA	
IRP-2	Basement	1	30	480V/3PH	HOA	
IRP-3	Basement	1	30	480V/3PH	HOA	

SCHEDULE E

Separation of Trades

NOT USED FOR SINGLE CONTRACTS

SCHEDULE F

Submittals Schedule

(Reference: Section 01 3300 Article 1.5 (C) of the General Conditions)

The Schedule set forth below lists all submittal requirements for the Contract. In the event of any conflict between the Specifications and this Schedule F, Schedule F shall take precedence; provided, however, in the event of an omission from Schedule F (i.e., Schedule F omits either a reference to or information concerning a submittal requirement which is set forth in the Specifications), such omission from Schedule F shall have no effect and the Contractor's submittal obligation, as set forth in the Specifications, shall remain in full force and effect.

CONSULTANT:
TELEPHONE NUMBER:
DDC PROJECT MANAGER:
TELEPHONE NUMBER:

DATE: _____

APPROVED: _____
(DDC RESIDENT ENGINEER/CPM)

REPORT DATE		FMS ID #/PROJECT ID #: CONTRACT REGISTRATION #: PROJECT NAME:							CONTRACT #: **Contract 1 – GENERAL CONSTRUCTION** TRADE: SHOP DRAWING LOG SHEET #								
SPEC. SECT. #	DESCRIPTION	COORD. WITH CONTR.	SUBMITTAL			SUB. DATE	REQ'D DEL.	FABRIC. TIME	SUBMISSIONS								
			SHOP DWG.	SAMPLE	CAT. CUTS				REC'D	RET'D	ACTION	REC'D	RET'D	ACTION	REC'D	RET'D	ACTION
013526	Safety and Health Program	X															
013526	Contractor's Safety Plan	X															
013591	Historic Treatment Plan	X															
015000	Site Plan		X														
015000	Reports	X															
015423	NYC DOB Scaffold & Sidewalk Shed Permits	X	X														

015423	Site Logistics/Site Safety Plan	X															
015423	Scaffold & Shed Installation Drawings		X														
017419	Waste Management Plan	X															
017900	Instruction Program for Demonstration & Orientation	X															
017900	Qualification Data	X															
01 8113.13	MSDS			X	X												
018119	IAQ Management Plan	X															
018119	Product Cut Sheets				X												
018119	IAQ Management Plan Photographs	X															
024000	Demolition of Existing Structures	X	X		X												
028013	Allowance for Incidental Asbestos	X															
033000	Cast In Place Concrete	X	X	X	X												
033519	Polished Concrete Floor Finishing	X	X	X	X												
034100	Precast Structural Concrete	X	X		X												

034500	Architectural Precast Concrete	X	X	X	X												
034900	Glass Fiber Reinforced Concrete	X	X	X	X												
035300	Concrete Topping	X	X	X	X												
042000	Unit Masonry	X	X	X	X												
044010	Gabion Site Walls	X	X	X	X												
044020	Exterior Stone Rockery	X		X	X												
044200	Exterior Stone Cladding	X	X	X	X												
051200	Structural Steel Framing	X	X		X												
051213	Architectural Exposed Structural Steel	X	X	X													
051250	Netting Barrier System	X	X	X	X												
053100	Steel Deck	X		X	X												
054000	Cold Formed Metal Framing	X	X	X	X												
055000	Miscellaneous Metals	X	X		X												
055020	Weathering Steel	X	X	X													
055210	Steel Pipe and Tube Railings	X	X	X	X												
057000	Ornamental Metals	X	X	X	X												
062000	Carpentry	X			X												
063000	Wood Bench	X	X	X	X												

064023	Architectural Woodwork	X	X	X	X												
071326	Sheet Membrane Waterproofing	X	X	X	X												
071413	Fluid Membrane Waterproofing	X	X	X	X												
072100	Thermal Insulation	X	X		X												
072423	Direct Applied Soffit Finish System	X	X	X	X												
072713	Non Permeable Self Adhered Air Vapor Barrier Membrane	X	X	X	X												
073360	Vegetated Roofing System	X	X	X	X												
076200	Sheet Metal Flashing & Trim	X	X	X	X												
077100	Roof Specialties & Accessories	X	X		X												
078413	Fire Stops & Smoke Seals	X	X		X												
079200	Joint Sealers	X	X	X	X												
079500	Expansion Control	X	X	X	X												
081113	Steel Doors & Frames	X	X		X												
081416	Wood Doors	X	X	X	X												
083113	Access Doors	X	X		X												
083316	Coiling Counter Doors	X	X		X												

083323	Overhead Coiling Doors	X	X	X	X												
083336	Side Sliding Grills	X	X		X												
084113	Aluminum Framed Entrances & Structural Glass Curtainwalls	X	X	X	X												
087100	Finish Hardware	X	X		X												
088000	Glass & Glazing	X	X	X	X												
089000	Louvers	X	X	X	X												
092400	Exterior Lath & Plaster	X	X	X													
092900	Gypsum Drywall	X	X	X	X												
093000	Ceramic Tile	X	X	X	X												
095113	Acoustic Panel Ceilings	X	X	X	X												
095133	Metal Ceilings	X	X	X	X												
096813	Carpet Tile	X	X	X	X												
099000	Painting & Finishing	X		X	X												
102114	Floor Mounted Toilet Partitions	X	X	X													
102213	Wire Mesh Partitions	X	X	X	X												
102226	Operable Partitions	X	X	X	X												
102800	Toilet Accessories	X	X		X												
107500	Flagpoles	X	X	X	X												

109000	Parking / Access Control Gate	X	X		X												
110100	Maintenance Fall Protection	X	X		X												
114800	Athletic and Recreational Equipment	X	X	X	X												
122413	Window Shades	X	X	X	X												
124813	Floor Mats & Frames	X	X	X	X												
129300	Site Furnishings	X		X	X												
133123	Tensioned Fabric Structures	X	X	X	X												
210517	Sleeves and Sleeve Seals for Fire-Suppression Piping	X			X												
210518	Escutcheons for Fire-Suppression Piping	X			X												
210548	Vibration and Seismic Controls for Fire-Suppression Piping and Equipment	X	X		X												
210553	Identification for Fire-Suppression Piping and Equipment	X		X	X												
211313	Wet-Pipe Sprinkler Systems	X	X		X												
211316	Dry-Pipe Sprinkler Systems	X	X		X												

220513	Common Motor Requirements for Plumbing Equipment	X			X												
220517	Sleeves and Sleeve Seals for Plumbing Piping	X			X												
220518	Escutcheons for Plumbing Piping	X			X												
220519	Meters and Gages for Plumbing Piping	X			X												
220523	General-Duty Valves for Plumbing Piping	X			X												
220529	Hangers and Supports for Plumbing Piping and Equipment	X	X		X												
220533	Heat Tracing for Plumbing Piping	X	X		X												
220553	Identification for Plumbing Piping and Equipment	X		X	X												
220719	Plumbing Piping Insulation	X	X	X	X												
221116	Domestic Water Piping	X			X												
221119	Domestic Water Piping Specialties	X	X		X												
221123.13	Domestic Water Packaged Booster Pumps	X	X		X												

221316	Sanitary Waste and Vent Piping	X	X		X												
221319	Sanitary Waste Piping Specialties	X	X		X												
221329	Sanitary Sewerage Pumps	X	X		X												
221413	Facility Storm Drainage Piping	X	X		X												
221423	Storm Drainage Piping Specialties	X	X	X	X												
221429	Sump Pumps	X	X		X												
223400	Fuel-Fired, Domestic-Water Heaters	X	X		X												
224213.13	Commercial Water Closets	X	X		X												
224213.16	Commercial Urinals	X	X		X												
224216.13	Commercial Lavatories	X	X		X												
224216.16	Commercial Sinks	X	X		X												
224223	Commercial Showers Receptors & Basins	X			X												
224500	Emergency Plumbing Fixtures	X	X		X												
224713	Drinking Fountains	X			X												
230010	Mechanical General Conditions	X	X	X	X												
230130.51	HVAC Air Duct Cleaning	X			X												

230513	Common Motor Requirements for HVAC Equipment	X			X												
230516	Expansion Fittings and Loops for HVAC Piping	X	X		X												
230517	Sleeves and Sleeve Seals for HVAC Piping	X			X												
230519	Meters and Gages for HVAC Piping	X	X		X												
230523	General-Duty Valves for HVAC Piping	X			X												
230529	Hangers and Supports for HVAC Piping and Equipment	X	X		X												
230533	Heat Tracing for HVAC Piping	X	X		X												
230548	Vibration Controls for HVAC	X	X		X												
230553	Identification for HVAC Piping and Equipment	X	X	X	X												
230593	Testing, Adjusting, and Balancing for HVAC	X			X												
230713	Duct Insulation	X	X	X	X												
230716	HVAC Equipment Insulation	X	X	X	X												

230719	HVAC Piping Insulation	X	X	X	X												
230800	Commissioning of HVAC and Plumbing Systems	X			X												
230900	Instrumentation and Control for HVAC	X	X		X												
230993	Sequence of Operations for HVAC Controls	X	X		X												
232113	Hydronic Piping	X	X		X												
232123	Hydronic Pumps	X	X		X												
232500	HVAC Water Treatment	X	X		X												
233113	Metal Ducts	X	X		X												
233300	Air Duct Accessories	X	X		X												
233416	Centrifugal HVAC Fans	X	X		X												
233600	Air Terminal Units	X	X		X												
233713	Diffusers, Registers, and Grilles	X	X	X	X												
234100	Particulate Air Filtration	X	X		X												
235533	Fuel-Fired Unit Heaters	X	X		X												
235700	Heat Exchangers for HVAC	X	X		X												
237200	Air-to-Air Energy Recovery Equipment	X	X		X												

237313	Modular Indoor Central-Station Air-Handling Units	X			X												
238146	Water-Source Unitary Heat Pumps	X	X	X	X												
238219	Fan Coil Units	X	X	X	X												
238236	Finned-Tube Radiation Heaters	X	X	X	X												
238239.19	Wall & Ceiling Unit Heaters	X	X	X	X												
238316	Radiant-Heating Hydronic Piping	X	X		X												
260500	Common Work Results for Electrical	X	X	X	X												
260519	Low-Voltage Electrical Power Conductors and Cables	X			X												
260523	Control-Voltage Electrical Power Cables	X			X												
260526	Grounding and Bonding for Electrical Systems	X			X												
260529	Hangers and Supports for Electrical Systems	X			X												
260533	Raceways and Boxes for Electrical Systems	X	X	X	X												

260543	Underground Ducts and Raceways for Electrical Systems	X	X		X												
260544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling	X			X												
260548	Vibration and Seismic Controls for Electrical Systems	X	X	X	X												
260553	Identification for Electrical Systems	X	X		X												
260573	Overcurrent Protective Device Coordination Study	X			X												
260923	Lighting Control Devices	X	X		X												
260943.23	Relay Based Lighting Controls	X	X		X												
262200	Low-Voltage Transformers	X	X		X												
262413	Switchboards	X	X		X												
262416	Panel boards	X	X		X												
262726	Wiring Devices	X	X	X	X												
262813	Fuses	X	X		X												
262816	Enclosed Switches and Circuit Breakers	X	X		X												
262913	Enclosed Controllers	X	X		X												

262923	Variable-Frequency Motor Controllers	X	X		X												
263323	Central Battery Equipment	X	X		X												
265100	Lighting Fixtures and Devices	X	X	X	X												
283111	Digital, Addressable Fire-Alarm System	X	X		X												
311000	Site Clearing	X			X												
312000	Earthwork	X			X												
312316	Rock Removal	X			X												
312319	Dewatering	X			X												
312500	Erosion and Sedimentation Controls	X			X												
313219	Geo Synthetic Soil Stabilization & Layer Separation	X		X	X												
315000	Excavation Support and Protection	X	X		X												
320516	Aggregate Paving	X	X	X	X												
321216	Bituminous Pavement	X	X		X												
321217	Aggregate Overlay over Asphalt	X	X	X	X												
321313	Cast in Place Concrete Paving	X	X	X	X												

321314	Cast in Place Concrete Paving - Pervious	X	X	X	X												
321400	Unit Paving	X	X	X	X												
321613	Concrete Curbs & Gutters	X	X		X												
327200	Plantings for Wetland Areas	X	X	X	X												
327300	Coir Fiber Blankets	X		X	X												
327400	Waterfowl Exclusion Barrier	X			X												
327500	Soil Mixes for Wetland Areas	X		X	X												
328000	Irrigation System	X	X	X	X												
328001	Irrigation Pump System	X	X		X												
329113	Planting Soil Mixes	X	X	X	X												
329300	Exterior Planting	X	X	X	X												
329301	Tree Protection	X															
330500	Common Work Results for Utilities	X			X												
333100	Sanitary Utility Sewerage Piping and Structures	X	X		X												
334000	Flap Gate	X	X		X												
334100	Storm Drainage System	X	X		X												
334500	Hydraulic Sluice Gate	X	X		X												
334600	Sub Drainage	X	X		X												

334610	Storm water Underground Detention	X	X	X	X												
334713	Wetland Liners	X	X	X	X												

TABLE OF CONTENTS
CONTRACT NO.1 GENERAL CONSTRUCTION

DIVISION 1	GENERAL REQUIREMENTS
013010	LEED Certification Requirements
014000	Quality Assurance Reference Mockups
DIVISION 2	EXISTING CONDITIONS
024000	Demolition of Existing Structures
028013	Allowance for Incidental Asbestos
DIVISION 3	CONCRETE
033000	Cast-in-Place Concrete
033519	Polished Concrete Floor Finishing
034100	Precast Structural Concrete
034500	Architectural Pre-Cast Concrete
034900	Glass Fiber Reinforced Concrete (GFRC) Panels
035300	Concrete Topping
DIVISION 4	MASONRY
042000	Unit Masonry
044010	Gabion Site Walls
044020	Exterior Stone Boulders
044200	Exterior Stone Cladding
DIVISION 5	METALS
051200	Structural Steel Framing
051213	Architecturally Exposed Structural Steel (AESS)
051250	Netting Barrier System
053100	Steel Deck
054000	Cold Formed Metal Framing
055000	Miscellaneous Metals
055020	Weathering Steel
055210	Steel Pipe and Tube Railings
057000	Ornamental Metals
DIVISION 6	WOOD, PLASTICS AND COMPOSITES
062000	Carpentry
063000	Wood Benches
064023	Architectural Woodwork
DIVISION 7	THERMAL AND MOISTURE PROTECTION
071326	Sheet Membrane Waterproofing
071413	Fluid Membrane Waterproofing
072100	Thermal Insulation
072423	Direct Applied Soffit Finish System
072713	Non-Permeable, Self-Adhered Air/Vapor Barrier Membrane
073360	Vegetated Roofing System
076200	Sheet Metal Flashing and Trim
077100	Roof Specialties and Accessories
078413	Fire stops and Smoke seals
079200	Joint Sealers
079500	Expansion Control

DIVISION 8	OPENINGS
081113	Steel Doors and Frames
081416	Wood Doors
083113	Access Doors
083316	Coiling Counter Doors
083323	Overhead Coiling Doors
083336	Side Sliding Grills
084113	Aluminum Framed Entrances and Structural Glass Curtain Walls
087100	Finish Hardware (Door Hardware)
088000	Glass and Glazing
089000	Louvers
DIVISION 9	FINISHES
092400	Exterior Lath and Plaster
092900	Gypsum Drywall
093000	Ceramic Tile
093310	Quarry Tile
095113	Acoustic Panel Ceilings
095133	Metal Ceilings
096813	Carpet Tile
099000	Painting and Finishing
DIVISION 10	SPECIALTIES
101400	Signage
102114	Floor Mounted Toilet Partitions
102213	Wire Mesh Partitions
102226	Operable Partitions
102800	Toilet Accessories
107500	Flagpoles
109000	Parking / Access Control Gate
DIVISION 11	- EQUIPMENT
110100	Fall Protection
114800	Athletic & Recreational Equipment
DIVISION 12	FURNISHINGS
122413	Window Shades
124813	Floor Mats and Frames
129300	Site Furnishings
DIVISION 13	SPECIAL CONSTRUCTION
133123	Tensioned Fabric Structures
DIVISION 21	FIRE PROTECTION
210517	Sleeves and Sleeve Seals for Fire-Suppression Piping
210518	Escutcheons for Fire-Suppression Piping
210548	Vibration and Seismic Controls for Fire-Suppression Piping and Equipment
210553	Identification for Fire-Suppression Piping and Equipment
211313	Wet-Pipe Sprinkler Systems
211316	Dry-Pipe Sprinkler Systems
213113	Electric Drive, Centrifugal Fire Pumps

DIVISION 22	PLUMBING
220513	Common Motor Requirements for Plumbing Equipment
220517	Sleeves and Sleeve Seals for Plumbing Piping
220518	Escutcheons for Plumbing Piping
220519	Meters and Gages for Plumbing Piping
220523	General-Duty Valves for Plumbing Piping
220529	Hangers and Supports for Plumbing Piping and Equipment
220533	Heat Tracing for Plumbing Piping
220553	Identification for Plumbing Piping and Equipment
220719	Plumbing Piping Insulation
221113	Facility Water & Distribution Piping
221116	Domestic Water Piping
221119	Domestic Water Piping Specialties
221123.13	Domestic Water Packaged Booster Pumps
221316	Sanitary Waste and Vent Piping
221319	Sanitary Waste Piping Specialties
221329	Sanitary Sewerage Pumps
221413	Facility Storm Drainage Piping
221423	Storm Drainage Piping Specialties
221429	Sump Pumps
223400	Fuel-Fired, Domestic-Water Heaters
224213.13	Commercial Water Closets
224213.16	Commercial Urinals
224216.13	Commercial Lavatories
224216.16	Commercial Sinks
224223	Commercial Showers Receptors & Basins
224500	Emergency Plumbing Fixtures
224713	Drinking Fountains

DIVISION 23	HEATING, VENTILATING AND AIR CONDITIONING
230010	Mechanical General Conditions
230130.51	HVAC Air-Distribution System Cleaning
230513	Common Motor Requirements for HVAC Equipment
230516	Expansion Fittings and Loops for HVAC Piping
230517	Sleeves and Sleeve Seals for HVAC Piping
230519	Meters and Gages for HVAC Piping
230523	General-Duty Valves for HVAC Piping
230529	Hangers and Supports for HVAC Piping and Equipment
230533	Heat Tracing for HVAC Piping
230548	Vibration Controls for HVAC
230533	Heat Tracing for HVAC Piping
230553	Identification for HVAC Piping and Equipment
230593	Testing, Adjusting, and Balancing for HVAC
230713	Duct Insulation
230716	HVAC Equipment Insulation
230719	HVAC Piping Insulation
230800	Commissioning of HVAC and Plumbing Systems
230900	Instrumentation and Control for HVAC
230993	Sequence of Operations for HVAC Controls
232113	Hydronic Piping
232123	Hydronic Pumps
232500	HVAC Water Treatment
233113	Metal Ducts
233300	Air Duct Accessories
233416	Centrifugal HVAC Fans
233600	Air Terminal Units
233713	Diffusers, Registers, and Grilles

234100	Particulate Air Filtration
235533	Fuel-Fired Unit Heaters
235700	Heat Exchangers for HVAC
237200	Air-to-Air Energy Recovery Equipment
237313	Modular Indoor Central-Station Air-Handling Units
238146	Water-Source Unitary Heat Pumps
238219	Fan Coil Units
238236	Finned-Tube Radiation Heaters
238239.19	Wall and Ceiling Unit Heaters
238316	Radiant-Heating Hydronic Piping

DIVISION 26	ELECTRICAL
260500	Common Work Results for Electrical
260519	Low-Voltage Electrical Power Conductors and Cables
260523	Control- Voltage Electrical Power Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceways and Boxes for Electrical Systems
260543	Underground Ducts and Raceways for Electrical Systems
260544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
260548	Vibration and Seismic Controls for Electrical Systems
260553	Identification for Electrical Systems
260573	Overcurrent Protective Device Coordination Study
260923	Lighting Control Devices
260943.23	Relay Based Lighting Controls
262200	Low-Voltage Transformers
262413	Switchboards
262416	Panel boards
262726	Wiring Devices
262813	Fuses
262816	Enclosed Switches and Circuit Breakers
262913	Enclosed Controllers
262923	Variable-Frequency Motor Controllers
263323	Central Battery Equipment
265100	Lighting Fixtures and Devices

DIVISION 28	ELECTRONIC SAFETY AND SECURITY
283111	Digital, Addressable Fire-Alarm System

DIVISION 31	EARTHWORK
311000	Site Clearing
312000	Earthwork
312316	Rock Removal
312319	Dewatering
312500	Erosion and Sedimentation Controls
313219	Geo Synthetic Soil Stabilization & Layer Separation
315000	Excavation Support and Protection

DIVISION 32	EXTERIOR IMPROVEMENTS
320516	Aggregate Paving
321216	Bituminous Pavement
321217	Aggregate Overlay over Asphalt
321313	Concrete Paving
321314	Cast in Place Concrete Paving - Pervious
321400	Unit Pavers
321613	Concrete Curbs and Gutters
327200	Plantings for Wetland Areas

327300	Coir Fiber Blankets
327400	Waterfowl Exclusion Barrier
327500	Soil Mixes for Wetland Areas
328000	Irrigation System
328001	Irrigation Pump System
328002	Manual Irrigation Scheduling
329113	Planting Soil Mixes
329300	Exterior Planting
329301	Tree Protection

DIVISION 33	UTILITIES
330500	Common Work Results for Utilities
333100	Sanitary Utility Sewerage Piping and Structures
334000	Flap Gate
334100	Storm Drainage System
334500	Hydraulic Sluice Gate
334600	Sub Drainage
334610	Storm water Underground Detention
334713	Wetland Liners

APPENDIX	
APPENDIX 1	Geotechnical Data Report – Volume 1 Report
APPENDIX 2	Geotechnical Data Report – Volume 2 Appendices
APPENDIX 3	Geotechnical Design Report – Volume 1 Report
(SEE DWG SET)	Geotechnical Design Report – Volume 2 Drawings
APPENDIX 4	Limited Environmental Subsurface Investigation
APPENDIX 5	Geotechnical Interpretive Design Report

END OF TABLE OF CONTENTS

THIS PAGE INTENTIONALLY LEFT BLANK

CONTRACT # 1

GENERAL CONSTRUCTION WORK

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 013010

SUSTAINABILITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall comply with LEED certification and LL86 requirements as shown on the Drawings and as specified herein.

1. Minimum 25% reduction in energy cost from ASHRAE 90.1-2007 baseline.
2. Minimum 30% reduction in potable water use from LEED Credit WE2 baseline (or 20% reduction if DOB rejects an application for the use of waterless urinals).

B. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental performance goals, which include achieving minimum LEED NC 2009 Silver Certification for the work done within LEED boundary.

C. Specific project goals that will impact this area of work include:

1. Use of materials with recycled-content
2. High-albedo paving materials
3. High-albedo roof materials
4. Construction waste management
5. Site soil erosion and sedimentation control

D. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the aforementioned environmental goals and LEED certification.

E. Work of this Section includes the following:

1. General requirements and procedures for compliance with U.S. Green Building Council (USGBC) LEED prerequisites and credits required for the Project to obtain a minimum LEED Silver rating based on LEED New Construction (NC), Version 2009.
2. Criteria required for materials and performance to contribute to LEED.
3. Procedures required to document compliance with LEED.

F. About LEED

1. The USGBC's Leadership in Energy and Environmental Design (LEED) is a system of assigning points (credits) to a projects based on sustainable building goals being met.
2. LEED has prerequisites that are required for the project to qualify.
3. Some LEED prerequisites and credits depend on material selections and may not be specifically identified as LEED requirements in this document.
4. Some LEED prerequisites and credits depend on Engineer's design and other aspects of Project that are not part of the work of the Contractor.
5. A copy of the LEED NC 2009 Reference Guide and Oct 2013 Addenda is available for download at the USGBC website: www.usgbc.org.

1.02 RELATED SPECIFICATIONS

A. Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

B. DDC General Conditions

C. Specification 024000 – Demolition of Existing Structures

D. Specification 033000 – Cast-In-Place Concrete

E. Specification 042000 – Unit Masonry

F. Specification 044010 – Gabion Site Wall

G. Specification 051213 – Architecturally Exposed Structural Steel

H. Specification 051250 – Netting Barrier System

I. Specification 054000 – Cold Formed Metal Framing

J. Specification 073360 – Vegetated Roofing System

K Specification 320516 – Aggregate Paving

L. Specification 321400 – Unit Paving

M. Specification 327200 – Planting for Wetland Areas

N. Specification 327500 – Soil Mixes for Wetland Areas

O. Specification 328000 – Irrigation System

P. Specification 329300 – Exterior Planting

Q. Specification 333100 – Sanitary Utility Sewerage Piping and Structures

1.03 REFERENCES AND REGULATORY REQUIREMENTS

A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.

1. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).

2. Carpet and Rug Institute (CRI)

3. Forest Stewardship Council (FSC)

4. Green Seal (GS)

5. Illuminating Engineering Society of North America (IESNA)

6. Sheet Metal and Air Conditional National Contractor Association (SMACNA)

7. South Coast Air Quality Management District (SCAQMD)

8. United States Environmental Protection Agency (USEPA)

9. United States Green Building Council (USGBC): Leadership in Energy and Environmental Design (LEEDTM) Green Building Rating System, Version 2.2

B. Rule 1168 – "Adhesive and Sealant Applications", effective date of July 1, 2005 and Rule Amendment date of January 7, 2005: South Coast Air Quality Management District (SCAQMD), State of California, www.aqmd.gov

C. "Green Seal Standard for Commercial Adhesives" (GS-36), requirements in effect October 19, 2000

D. "Green Seal Standard for Architectural Coating" (GS-11), plus "Green Seal Standard for Anti-Corrosive Paints" (GC-03)

E. Rule 1113 – "Architectural Coatings", amended 7/9/04: South Coast Air Quality Management District (SCAQMD), State of California, www.aqmd.gov

F. SMACNA/ANSI 008-2008 – IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, http:/ / www.smacna.org

G. ANSI/ASHRAE 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size", www.ashrae.org

H. ANSI/ASTM-E779-03 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

I. ASHRAE 55-2004 – Thermal Comfort Conditions for Human Occupancy.

J. ASHRAE 62.1-2007 - Ventilation for Acceptable Indoor Air Quality.

K. ASTM C1371-04 – Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

L. ASTM C1549-04 – Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.

M. ASTM E408-71(1996)e1 – Standard Test Methods for Total Normal Emittances of Surfaces Using Inspection-Meter Techniques.

N. ASTM E903-96 – Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres

O. ASTM E1371-04 – Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.

P. ASTM E1903-97 – Phase II Environmental Site Assessment.

Q. ASTM E1918-97 – Standard Test Method for Measuring Solar Reflectance of Horizontal And Low-Sloped Surfaces in the Field.

R. ASTM E1980-01 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

S. CIBSE – Applications Manual 10: 2005, Natural Ventilation in Non-Domestic Buildings

T. CRI – Green Label Plus Testing Program.

U. EPA – Brownfields Definition – Sustainable Redevelopment of Brownfields Program.

V. EPA – Energy Policy Act (EPAct) of 1992, Fixture Flow Requirements.

W. EPA 24

X. EPA 832-R-92-005 – Storm Water Management for Construction Activities, Chapter 3.

Y. EPA 840-B-92-002, Jan 1993 – Guidance Specifying Management Measures for Sources of Non-Point Pollution in Coastal Waters

Z. EPA PB90200288 – Compendium of Methods for the Determination of Air Pollutants in Indoor Air.

AA. FEMA – 100-Year Flood Definition.

BB. FWS – Endangered Species List.

CC. Green-e – Center for Resource Solutions' Electricity Product Certification Requirements.

DD. IPMVP – International Performance Measurement and Verification Protocol, Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003.

EE. ISO 14021-1999 –Environmental Labels and Declarations.

FF. The Carbon Trust Good Practice Guide 237 – Natural Ventilation in Non-Domestic Buildings.

GG. US Code of Federal Regulations – Definition of Prime Agricultural Land, Title 7, Volume 6, Parts 400-699, Section 657.5.

HH. US Code of Federal Regulations – Definition of Wetlands, 40 CFR, Parts 230-233, and Part 22.

1.04 DEFINITIONS

A. Albedo: A surface's solar reflectance.

B. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by a Forest Stewardship Council (FSC)-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

C. Chlorofluorocarbons (CFCs): Hydrocarbons that deplete the stratospheric ozone layer.

D. Hydrochlorofluorocarbons (HCFCs): Refrigerants used in building equipment that deplete the stratospheric ozone layer, but to a lesser extent than CFCs.

E. FSC Certified Content: Wood content that has been harvested in accordance with the "FSC Principles and Criteria" for well-managed forests developed by the Forest Stewardship Council (FSC).

F. LEED (Leadership in Energy & Environmental Design): A green building rating system, developed by the U.S. Green Building Council (USGBC) that provides standards for environmentally sustainable construction.

G. LEED Accredited Professional: He/She who passed the LEED Accreditation Exam.

H. Point of Harvest/Extraction/Recovery: Location where raw material is gathered for use in production.

I. Point of Final Assembly: Location where individual components are assembled into a product that is furnished and installed by tradesmen.

J. Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within a 500 radius miles of the Project site. If only a fraction of a product or material is extracted/harvested/recovered locally, then only that percentage (by weight) shall contribute to the regional value.

K. Recycled Content: There are two types of recycled content in building materials:

1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose (i.e. recycled plastic bottles).

2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process (i.e. sawdust). Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

L. Salvaged Content: Materials (from another building) that have been salvaged, refurbished, or reused.

M. Solar Reflectance Index (SRI): A measure of a material's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.9) is equal to 0, and a standard white (reflectance 0.80, emittance 0.90) is equal to 100.

N. Sustainability/LEED Consultant: He/She who has the expertise in sustainable building design and capable of guiding the design team to design a building to LEED standards and to coordinate the documentation process that is necessary for LEED certification.

O. VOC: Volatile Organic Compound (as formaldehyde or gasoline) that evaporate quickly especially from paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials and furnishings that contribute to photochemical smog in the atmosphere and may have short- and long-term adverse health effects.

1.05 SUBMITTALS

A. The following Action Plans below will form the basis for compliance with materials-related LEED credits. Contractors should identify the available building materials that will achieve or exceed the targeted performance requirements in the LEED Compliance Requirements Section below:

1. High Albedo Materials Plan: List materials, location of usage, square footage of hardscape or roof area materials will cover, and confirm their compliance with the requirements for the following:
   a. Non roofing materials (paving and walkways). Provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying a minimum Solar Reflectance Index (SRI) value of 29.
      1). SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.
      2). Verify that any blended cements (i.e. black slag or fly ash cements) comply with these requirements.
   b. Roofing materials: Provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying a minimum Solar Reflectance Index (SRI) of:
      1). 79 low-sloped roofing applications (slope $\leq$ 2:12) or
      2). 29 for steep-sloped roofing applications (slope $\geq$ 2:12)
      3). SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371.

2. Recycled Content Plan with list of proposed materials with recycled content. Indicate material cost (without labor and equipment), post-consumer recycled content, and pre-consumer recycled content for each product with the potential to have recycled content. Provide published product literature or letter of certification on the manufacturer's letterhead certifying the amounts of postconsumer and/or post-industrial content. Only permanently installed materials in the Project shall be included.
   a. For black slag or fly-ash in the concrete mix, the value of cementitious materials will be needed from concrete supplier separately from the total cost of the concrete. Note: USGBC considers fly ash and black slag a pre-consumer recycled content material.
   b. For products with multiple materials, consider the percent by weight of the post-consumer recycled content and the pre-consumer recycled content in the assembly. Divide the weight of the recycled content by the overall weight of the assembly.

B. LEED Progress Reports: The Contractor must submit 2 monthly reports to the Owner with invoices and material content verification from manufacturers (MSDS, cut sheets, Chain-of-Custody Certificate Numbers, letters from manufacturers, hauling receipts, etc.) for installed materials. Reports should compare actual construction and purchasing activities with LEED Action Plans for the following on provided Contractor Submittal Templates:

1. Construction Waste Management Submittal Template completed per General Conditions Specification 017419 – Construction Waste Management and Disposal

2. Materials Reporting Form completed per General Conditions Specification 018113 – Sustainable Design Requirements for LEED Buildings

C. For all products containing recycled content except mechanical, electrical, and plumbing components, submit a cut sheet or a written affidavit on company letterhead (email is not acceptable) included with the product submittal from the manufacturer indicating:

1. The percentage by material weight of post-consumer recycled content.

2. The percentage by material weight of pre-consumer recycled content.

D. For all products with a Point of Harvest/Extraction/Recovery within 500 miles of the Project Site except mechanical, electrical, and plumbing components, submit a cut sheet or a written affidavit from the manufacturer indicating:

1. The product Point of Final Assembly.

2. Any product component materials harvested, extracted, or recovered within 500 miles of the Project site and the material percentage by weight.

3. The distance, in miles, from the Point of Final Assembly to the Project location measured as the most direct route between the two points.

E. For all composite wood and agrifiber products, including core materials, submit a cut sheet or written affidavit from the manufacturer stating that they contain no added urea-formaldehyde resins or adhesives.

F. For all laminating adhesives, submit a cut sheet or written affidavit from the manufacturer stating that they contain no added urea-formaldehyde.

G. For the products listed below, submit the following included with the product submittal:

1. Roof System Components: Cut sheet indicating that materials are Energy Star compliant and meet or exceed a Solar Reflectance Index (SRI) of 78 for low-sloped roof or 29 for steep-sloped roof.

2. Stormwater filtration devices: Cut sheets or written affidavit from the manufacturer indicating the percentage of Total Suspended Solids filtered and the percentage of Total Phosphorous filtered by the devices.

3. For all sealants & adhesives (including floor sealers, tile setting adhesives, and grout) and paints & coatings (including floor finishes) installed within the weather barrier of the LEED building, submit a cut sheet, MSDS, or written affidavit from the manufacturer stating the product's VOC content (less water) in g/L.

4. For all flooring systems other than unfinished mineral or wood flooring, submit a cut sheet or written affidavit from the manufacturer verifying the product's Green Label, Green Label Plus, or FloorScore rating.

H. Construction Materials Summary Report: After substantial completion of the project, the Contractor shall prepare and submit a Construction Material Summary Report.

1. The Construction Materials Summary Report shall be organized by LEED credit, compiled and bound at the end of construction. This bound document (either paper or electronic) shall be submitted to Atelier Ten and the Owner.

2. The Construction Materials Summary Report shall contain:
   a. Total project material cost, which excludes related labor and equipment costs, and which excludes all mechanical, electrical, and plumbing components and related costs.
   b. A summary by construction division of material costs, less related labor and equipment costs.
   c. A summary by construction division of all products containing recycled content, including the product material costs and the product percentages of post-consumer recycled content and post-industrial recycled content.
   d. A summary by construction division of the value of materials and products that have a Point of Final Assembly within 500 miles of the Project site.
   e. A summary by construction division of the value of materials that are extracted, harvested, or recovered (as well as manufactured) within 500 miles of the Project site.
   f. For any materials with recycled content, cut sheets or written affidavits from manufacturers listing the material percentage by weight of post-consumer recycled content and post-industrial recycled content.
   g. For any materials with a Point of Final Assembly or an extraction, harvest, or recovery site within 500 miles of the Project, cut sheets with manufacturing and extract location or written affidavit from the manufacturer listing the distance from the manufacture or extract location to the Project site.

I. LEED Application Documentation: At or before substantial completion, the Contractor shall prepare LEED Letter Templates and supporting documentation for each LEED construction credit to be attempted.

1. LEED Letter Template shall be downloaded from the LEED Online website and distributed to the Contractor by the commissioner.

2. Commissioner shall prepare and distribute Documentation Matrix to the Contractor. The Documentation Matrix illustrates the deliverables required to adequately record that the project has met the intent of each credit.

3. Contractor shall send completed LEED Letter Templates and associated documentation to the Sustainability/commissioner for review and comment. LEED Letter Template shall contain:
   a. All proper data fields completed declaring that the project has met the intent of the credit, including a narrative when applicable.
   b. Electronic signature of Contractor and date signed.

4. Once approved, the Contractor shall upload LEED Letter Templates and documentation to the LEED Online website.

J. Additional LEED submittals as required by other Specification Sections.

K. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

L. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project

M. Final LEED Materials Calculations: Before request for Completion, submit three (3) copies of the respective Contractor Submittal Templates to the Owner with calculated end-of-Project rates for the following:

1. Construction Waste Management Plan (refer to Specification 017419 – Construction Waste Management and Disposal.)

2. High Albedo Materials

3. Recycled Content

4. Regional Materials

5. Certified Wood

1.06 QUALITY ASSURANCE

A. Contractor's Quality Control Responsibilities: Contractor is solely responsible for quality control of the Work, assuring adherence to LEED Compliance Requirements and taking corrective action when LEED Action Plans are not followed, LEED goals are at risk or at the request of the Owner.

B. LEED Coordinator: Designate a Contractor Representative that is a LEED Accredited Professional (AP) by the USGBC and who has worked on at least one LEED New Construction job site. Contractor's LEED AP shall distribute the LEED Action Plans to all prime Contractors and Sub-Contractors, shall monitor compliance with the LEED Action Plans, shall instruct workers concerning these goals, and shall be present on site when Work is in progress. In addition, the LEED Coordinator must:

1. Provide LEED Compliance Requirements orientation for workers performing Work on the Project site.

2. Organize and conduct a LEED kick-off meeting(s) prior to construction outlining all LEED Compliance Requirements (distribute the LEED Action Plans as well) with all prime Contractors Project Managers, sub-Contractors, Contractor's Construction Waste Manager, the Engineer, and representatives from the Owner.

3. Prepare the Waste Management Plan for approval by the Owner.

4. Prepare the monthly progress reports on the Contractor Submittal Templates.

5. CM to keep back-up files (i.e. invoices, hauling receipts, Chain-of-Custody Certificate Numbers, letters from manufactures and all other information relevant to LEED Compliance).

6. Store back-up material for a potential audit for three years after substantial completion.

C. Site Stormwater Filtration: Remove a minimum of 80% of suspended solids and 40% of total phosphorus from site stormwater runoff.

1.07 LEED COMPLIANCE REQUIREMENTS

A. Erosion and Sedimentation Control (ESC) Plan that complies with LEED SS prerequisite 1.

B. High Albedo Materials

1. Non-Roof: Per LEED credit SS 7.1, Contractor must ensure that no less than 50% of the site hardscape (including walkways) have a minimum Solar Reflectance Index (SRI) value of 29

2. Roof: Per LEED credit SS 7.2, Contractor must ensure that no less than 75% of all exposed roof surfaces (including roofing membranes, pavers, and ballast products) meet the following minimum Solar Reflectance Index (SRI) values:
   a. 79 low-sloped roofing applications (slope $\leq$ 2:12)
   b. 29 for steep-sloped roofing applications (slope $\geq$ 2:12)

C. Construction Waste Management:

1. Per General Conditions Specification 017419 – Construction Waste Management and Disposal

2. Per LEED credit MR 2.2: Contractor must comply with Specification 017429 – Construction Waste Management and Disposal.

D. Recycled Content:

1. Per LEED credit MR 4.2: Contractor must use materials with recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitute at least 20% (based on cost) of the total value of the Project materials.
   a. Project materials presumed to help with this goal include: black slag/fly ash in all concrete mixes, all steel, all aluminum, certain plastics, etc.

PART 2 PRODUCTS

2.01 UNAUTHORIZED PRODUCTS

A. Related section: General Conditions Specification 018113.13 – VOC Limits for Adhesives, Sealants, Paints and Coatings for LEED Buildings.

B. Materials and products required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCBs) or other hazardous materials identified by the Owner.

2.02 AGRIFIBER PRODUCTS

A. Agrifiber board products must contain no added urea-formaldehyde resins.

PART 3 EXECUTION

3.1 LEED APPRAISAL (see following pages)

LEED 2009 for New Construction
3500 Croton Water Treatment Plant

Design Phase Credit

Certified 40 to 49 points **Silver** 50 to 59 points **Gold** 60 to 79 points **Platinum** 80 or more points

Achievability rating: **Hi** = 90%, **Med** = 60%, **Low** = 10%, **NP** = not possible.

Achievability						
hi		med	low	NP		
70		10	4	26	69	Projected Points
						Prerequisite
Y					SS Prereq 1	**Construction Activity Pollution Prevention**
Y					WE Prereq 1	**Water Use Reduction:** 20%
Y					EA Prereq 1	**Fundamental Commissioning of Building Energy Systems**
Y					EA Prereq 2	**Minimum Energy Performance**
Y					EA Prereq 3	**Fundamental Refrigerant Management**
Y					MR Prereq 1	**Storage & Collection of Recyclables**
Y					IEQ Prereq 1	**Minimum IAQ Performance**
Y					IEQ Prereq 2	**Environmental Tobacco Smoke (ETS) Control**
						Credit
				1	SS Credit 1	**Site Selection**
				5	SS Credit 2	**Development Density and Community Connectivity**
				1	SS Credit 3	**Brownfield Redevelopment**
				6	SS Credit 4.1	**Alternative Transportation:** Public Transportation Access
				1	SS Credit 4.2	**Alternative Transportation:** Bicycle Storage & Changing Rooms
				3	SS Credit 4.3	**Alternative Transportation:** Low-Emitting and Fuel-Efficient Vehicles
				2	SS Credit 4.4	**Alternative Transportation:** Parking Capacity
				1	SS Credit 5.1	**Site Development:** Protect or Restore Habitat
				1	SS Credit 5.2	**Site Development:** Maximize Open Space
				1	SS Credit 6.1	**Stormwater Design:** Quantity Control
				1	SS Credit 6.2	**Stormwater Design:** Quality Control
				1	SS Credit 7.1	**Heat Island Effect:** Non-Roof
				1	SS Credit 7.2	**Heat Island Effect:** Roof
				1	SS Credit 8	**Light Pollution Reduction**

Create and implement erosion control plan that meets the 2003 EPA Construction General Permit.	
Reduce water use by 20% over the baseline specified in LEED.	
Engage commissioning agent, and develop and execute a commissioning plan.	
Reduce energy cost by 10%, compared to ASHRAE 90.1-2007, Appendix G	
Eliminate CFCs in building HVAC&R.	
Provide space for the collection and storage of paper, cardboard, glass, plastic, and metals.	
Meet sections 4 through 7 of ASHRAE 62.1-2007.	
Prohibit smoking inside building, and locate exterior smoking areas at least 25 feet away from building.	
Do not develop sites that are prime farmland, floodplains or wetlands, parkland, or key habitat.	
Locate project in dense areas or near key community services.	
Locate project on a remediated brownfield site.	
Locate project within 1/2 mile of a rail station or 1/4 mile of two bus lines.	
Provide bicycle racks for 5% of building occupants and showers for 0.5% of FTE occupants.	
Provide preferred parking for hybrid vehicles for 5% of the project's parking capacity.	
Do not exceed zoning parking requirements; provide preferred carpool parking for 5% of parking capacity.	
Restore 50% of site open space or 20% of the total site, whichever is greater, for native/adapted vegetation.	
Exceed zoning open space requirements by 25%.	
No net increase site runoff, OR, reduce over existing conditions by 25%.	
Develop stormwater plan that meets local best management practice, and removes 80% TSS.	
Use open-grid paving, light-colored paving, or provide shade on 60% of all hardscape.	
Use light-colored membrane for 75% of roof or vegetated roof for 50% of roof.	
No nighttime light trespass from building AND meet exterior lighting requirements of ASHRAE 90.1-2007.	

2			WE	Credit 1	**Water Efficient Landscaping:** 50% Reduction	Reduce potable water used for irrigation by 50%
2			WE	Credit 1	**Water Efficient Landscaping:** No Potable Water	No potable water use for irrigation.
2			WE	Credit 2	**Innovative Wastewater Technologies**	Reduce water used for sewage conveyance by 50%.
4			WE	Credit 3	**Water Use Reduction:** 30% / 35% / 40%	Reduce water use by 30%/35%/40% over the baseline specified in LEED.
3			EA	Credit 1	**Optimize Energy Performance:** 12% / 14% / 16%	Reduce building energy cost by 12%/ 14%/ 16% compared to ASHRAE 90.1-2007, Appendix G.
3			EA	Credit 1	**Optimize Energy Performance:** 18% / 20% / 22%	Reduce building energy cost by 18%/ 20%/ 22% compared to ASHRAE 90.1-2007, Appendix G.
3			EA	Credit 1	**Optimize Energy Performance:** 24% / 26% / 28%	Reduce building energy cost by 24%/ 26%/ 28% compared to ASHRAE 90.1-2007, Appendix G.
1		2	EA	Credit 1	**Optimize Energy Performance:** 30% / 32% / 34%	Reduce building energy cost by 30%/ 32%/ 34% compared to ASHRAE 90.1-2007, Appendix G.
		3	EA	Credit 1	**Optimize Energy Performance:** 36% / 38% / 40%	Reduce building energy cost by 36%/ 38%/ 40% compared to ASHRAE 90.1-2007, Appendix G.
		4	EA	Credit 1	**Optimize Energy Performance:** 42% / 44% / 46% / 48%	Reduce building energy cost by 42%/ 44%/ 46%/ 48% compared to ASHRAE 90.1-2007, Appendix G.
		2	EA	Credit 2	**On-Site Renewable Energy:** 1% / 3%	Produce renewable energy on-site for 1%/ 3% of building energy consumption, calculated by cost.
		2	EA	Credit 2	**On-Site Renewable Energy:** 5% / 7%	Produce renewable energy on-site for 5%/ 7% of building energy consumption, calculated by cost.
		3	EA	Credit 2	**On-Site Renewable Energy:** 9% / 11% / 13%	Produce renewable energy on-site for 9%/ 11%/ 13% of building energy consumption, calculated by cost.
2			EA	Credit 3	**Enhanced Commissioning**	Design review, post occupancy review, recommissioning manual.
2			EA	Credit 4	**Enhanced Refrigerant Management**	Select refrigerants with low global warming potential and ozone depletion potential.
		3	EA	Credit 5	**Measurement & Verification**	Develop and implement an M&V plan that meets IPMVP, Options B or D.
		2	EA	Credit 6	**Green Power**	Purchase Green-e certified electricity supply for 2 years, for 35% of building's electricity demand.
		3	MR	Credit 1.1	**Building Reuse:** Maintain Existing Walls, Floors, & Roof, 55% / 75% / 95%	Maintain existing structure and envelope for 55% / 75% / 95% of the existing building.
		1	MR	Credit 1.2	**Building Reuse:** Maintain Existing Interior Nonstructural Elements, 50%	Use existing interior nonstructural elements in at least 50% of the completed building.
2			MR	Credit 2	**Construction Waste Management:** 50% / 75%	Create a construction waste management plan and recycle and/or salvage construction waste.
		2	MR	Credit 3	**Materials Reuse:** 5% / 10%	Use salvaged, refurbished, or reused materials for 5% / 10% of construction materials, calculated by cost.
1	1		MR	Credit 4	**Recycled Content:** 10% / 20% (post-consumer + 1/2 pre-consumer)	Use materials or products with recycled content for 10% / 20% of construction materials, calculated by cost.
	2		MR	Credit 5	**Regional Materials:** 10% / 20%	Use materials extracted and manufactured within 500 miles for 10%/20% of construction materials, calculated by cost.
		1	MR	Credit 6	**Rapidly Renewable Materials**	Use rapidly renewable materials for 2.5% of construction materials, calculated by cost.
	1		MR	Credit 7	**Certified Wood**	Use FSC-certified wood for 50% of wood-based materials, calculated by cost.

| | | |

This Page Intentionally Left Blank

SECTION 014000

QUALITY ASSURANCE REFERENCE MOCKUPS

PART 1 - GENERAL

1.01 CONSTRUCTION QUALITY ASSURANCE GOALS

A. To achieve a high quality of workmanship across the project, a selection of existing reference mockups on the adjacent site will serve as a required standard for new construction. These existing mockups are located within the NYC Department of Environmental Protection's portion of the Croton Water Treatment Plant site and will be available for viewing during the pre-construction walk-through.

B. In addition to the existing reference mockups located at the DEP water filtration plant site noted in this section, additional new on-site mockups and material samples of work shall be submitted by the contractor for the project per the specific requirements described in each section below.

1.02 RELATED SPECIFICATIONS

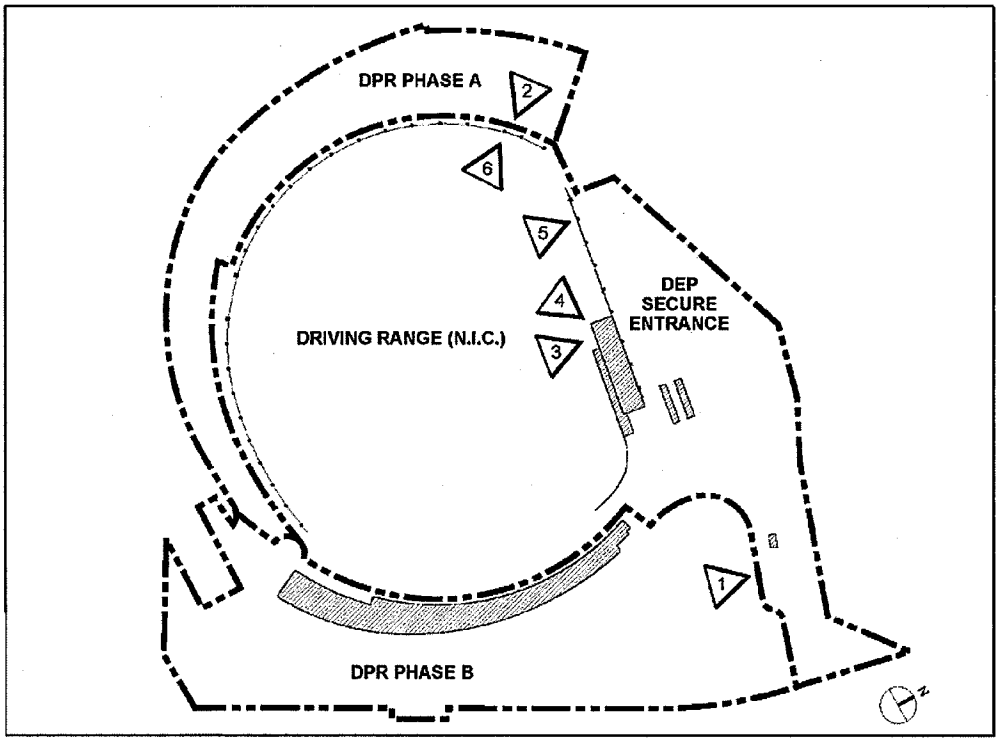
034900	Glass Fiber Reinforced Concrete (GFRC) Panels
044010	Gabion Walls
044300	Stone Masonry Units
044200	Exterior Stone Cladding
051213	Architecturally Exposed Structural Steel (AESS)
055020	Weathering Steel

1.03 LOCATIONS OF REFERENCE MOCKUPS

A. Refer to diagram on following page for locations of existing reference mockups to be viewed during the pre-bid / pre-construction walk through.

B. Quality Assurance Existing Reference Mockup locations Noted in Site Diagram to follow:

1. Stone Clad Site Wall
2. Gabion Site Wall
3. Stone Clad Building Wall
4. GFRC Roof Eave
5. Weathering Steel
6. Architecturally Exposed Structural Steel



Croton Water Treatment Plant Quality Assurance Reference Diagram N.T.S.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 024000

DEMOLITON OF EXISTING STRUCTURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, and services needed to complete the demolition, removal and disposal work as shown on the Contract Drawings or as directed by the Commissioner.

1.3 SECTION INCLUDES

A. Included, but not limited to, are demolition and removals of existing materials, structures, equipment, or work necessary to install the new Work as shown and specified and to connect same with existing work in an approved manner. Demolition includes structural concrete, foundations, walls, doors, windows, structural steel, metals, roofs, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, paving, curbs, walks, fencing, and similar existing facilities.

B. Demolitions and removals which may be specified under other Sections shall conform to requirements of this Section.

C. The removal of all equipment, piping, pumps, and all other materials from the demolition of buildings and structures shall, when released by the Commissioner, become Contractor's property, unless otherwise noted. The debris shall be disposed of offsite as required by the Contract documents.

D. Contractor shall obtain all required permits from the City of New York and other agencies having jurisdiction.

1.4 RELATED SPECIFICATIONS

A. Section 311000 - Site Clearing

B. Section 315000 - Excavation Support and Protection

C. Section 312500 – Erosion and Sedimentation Control

1.5 REFERENCES

A. Reference Standards: Regarding closure of underground storage tanks, Contractor shall comply with the applicable provisions and recommendations of the following, unless otherwise shown or specified:

1. 29 CFR 1518 - Safety and Health Regulations for Construction
2. 29 CFR 1910 - Occupational Safety and Health Standards
3. ANSI A10.2 - Safety Code for Building Construction
4. AWS D12.1 - Reinforcing Steel Welding Code

1.6 SUBMITTALS

A. Contractor shall submit working drawings, shop drawings and material specifications for the approval of the Commissioner in accordance with the requirements of the General Conditions of this Specification.

B. Working drawings and shop drawings shall include, but not be limited to proposed methods, equipment and operating sequences to be used in performance of the demolition and removals work and handling of hazardous materials.

C. Schedule: Show coordination of operations and sequence for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of City's operations.

D. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.7 JOB CONDITIONS

A. Protection:

1. Demolition and removal work shall be performed by competent workmen experienced in the various types of demolition and removal work required and it shall be carried through to completion with the prevention of damage or injury to structures, occupants thereof, City employees, work persons on the site, the public and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use of, and free and safe passage to and from, adjacent structures.

2. Contractor shall provide, erect and maintain catch platforms, lights, barriers, weather protection, warning signs and other items as required for proper protection of the public, occupants of the building, work persons engaged in demolition operations, and adjacent construction.

3. Contractor shall provide and maintain temporary protection of the existing structure designated to remain where demolition, removal and new work is being done, connections made, materials handled or equipment moved.

4. Contractor shall be responsible for any damage to the existing structure or contents by reason of providing insufficient protection.

5. Contractor shall take necessary precautions to control dust as required by Section 312500 – Erosion and Sediment Control. Dust shall be prevented from rising by

wetting demolished masonry, concrete, plaster and similar debris. Unaltered portions of the existing buildings affected by the operations under this Section shall be protected by dustproof partitions and other adequate means.

6. Contractor shall carry out all operations so as to avoid interference with operations and work in the existing facilities and the work under other contracts.

7. Any equipment, piping and appurtenances removed without proper authorization, and that is necessary for the operations of the existing or expanded plant, shall immediately be replaced to the satisfaction of the Commissioner at no cost to the City.

8. The work shall comply with the applicable provisions and recommendations of ANSI A10.2, Safety Code for Building Construction, all governing codes and as hereinafter specified.

9. Contractor shall make such investigations, explorations and probes as are necessary to ascertain any required protective measures before proceeding with demolition and removal.

10. Demolition and removal of hazardous materials shall be in accordance with applicable Federal, State and Local regulations.

B. Permits: Obtain all permits required for closing or obstructing streets and sidewalks.

C. Condition of Buildings, Structures and Equipment:

1. The City does not assume responsibility for the actual condition of buildings, structures and equipment to be demolished and removed.

2. Conditions existing at the time of inspection for bidding purposes will be maintained by the City so far as practicable. However, there is no guarantee by the City that the number of fixtures, amount of equipment or any other material of value existing at bidding time in the buildings and structures to be demolished will be present in the structures when they are demolished. Contractor shall have no claim against the City because of the absence of such fixtures and materials.

3. The information regarding the existing structures and equipment shown on the Drawings is based on visual inspection and a walk-through survey only. Neither the Commissioner nor the City will be responsible for interpretations or conclusions drawn there from by Contractor.

D. Notification: At least 48 hours prior to commencement of a demolition or removal, Contractor shall notify the Commissioner in writing of his proposed schedule. City will inspect the existing equipment or facilities and review with the Contractor those items which are to remain the property of the City. No removals shall be started without the permission of the Commissioner.

E. The use of explosives will not be permitted.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

A. The work required shall be done with care, and shall include all necessary shoring, bracing, and support to prevent movement, settlement, or collapse of existing structures or facilities. Contractor shall be responsible for any damage which may be caused by demolition and removal work to any part or parts of existing structures or items designated for reuse or to remain. Contractor shall perform patching, restoration and new work in accordance with applicable technical sections of the Specifications and in accordance with the details shown on the Drawings.

B. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces, which have holes, scars, chipped or other damaged surfaces revealed by the removal, shall be repaired by Contractor with the same or matching materials as the existing surface or as may be otherwise approved by the Commissioner.

C. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with Section 312500 – Erosion and Sediment Control and all governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the work.

3. The use of calcium chloride for dust control will not be allowed.

D. All supports, pedestals and anchors shall be removed with the equipment and piping unless otherwise specified or required. Concrete bases, anchor bolts and other supports shall be removed to approximately one inch below the surrounding finished area, and the recesses shall be patched to match the adjacent areas. Superstructure wall and roof openings shall be closed, and damaged surfaces shall be patched to match the adjacent areas, as specified under applicable sections of the Specifications, as shown on the Drawings, or as directed by the Commissioner. Wall sleeves and castings shall be plugged or blanked off, all openings in concrete shall be closed in a manner meeting the requirements of the appropriate sections of the Specifications, as shown on the Drawings and as directed and approved by the Commissioner.

E. Any materials or items designated to remain the property of the City shall be removed with care and stored at locations designated by the City .

F. Where equipment is shown or specified to be removed and relocated, Contractor shall not proceed with removal of this equipment without specific prior approval of the

Commissioner. Upon approval, and prior to commencing removal operations, the equipment shall be operated in the presence of representatives of Contractor, City and the Commissioner. Such items shall be removed with care, under the supervision of the trade responsible for reinstallation, and shall be protected and stored until required. Material or equipment damaged during removal shall be replaced with similar new material or equipment. Any equipment that is removed without proper authorization and is required for plant operation shall be replaced at no cost to the City.

G. Wherever piping is to be removed for disposal, the piping shall be drained by Contractor, and adjacent pipe and headers that are to remain in service shall be blanked off or plugged and then anchored in an approved manner.

H. Where alterations occur, or new and old work join, Contractor shall cut, remove, patch, repair or refinish the adjacent surfaces to the extent required by the construction conditions, so as to leave the altered work in as good a condition as existed prior to the start of the work. The materials and workmanship employed in the alterations shall be of the same quality as required for new work of the same type.

I. Contractor shall confine cutting of existing roof areas designated to remain to the limits required for the proper installation of the new work. Contractor shall cut an remove insulation and weather protection, and provide temporary weather-tight protection as required until new roofing and flashings are installed.

J. Contractor shall remove temporary work, such as enclosures, signs, guards, and the like when such temporary work is no longer required or when directed at the completion of the work.

K. Contractor shall dispose of all demolition materials, equipment debris, and all other items not marked or specified by the City or the Commissioner to remain as property of the City, off site and in conformance with all existing applicable laws and regulations.

L. Building Demolition:

1. Unless otherwise approved by the Commissioner, proceed with demolition from the top of the structure to the ground. Complete demolition work above each floor or tier before disturbing supporting members of lower levels.

2. Demolish concrete and masonry in small sections.

3. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.

4. Break up and remove foundations and slabs-on-grade, unless otherwise shown to remain.

5. Locate equipment used for demolition work, and remove demolished materials, so as not to impose excessive loads on supporting walls, floors or framing.

3.2 STRUCTURAL REMOVALS

A. Contractor shall remove concrete, structures and sub-structures to the lines and grades shown unless otherwise directed by the Commissioner. Where no limits are shown, the limits shall be 6 feet below final finished grade, unless otherwise approved by the Commissioner. The removal of masonry beyond these limits shall be at Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Commissioner with no additional compensation to the Contractor.

B. Determine the thickness of existing concrete to be removed and the extent to which it is reinforced. No additional compensation will be made because of variations from the thickness shown or for variations in the amount of reinforcement.

C. All concrete, stone, masonry, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site and disposed of at a permitted facility. Demolished items shall not be used in backfill.

D. After removal of parts or all of masonry walls, slabs and like work which tie into new work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and finished surfaces exposed.

E. When conducting demolition activities on masonry materials (i.e., brick and concrete), the Contractor shall perform work area and personal exposure monitoring in accordance with applicable regulations and standard industrial hygiene methods, until sufficient data is generated to demonstrate compliance with permissible exposure limits for crystalline silica, as calculated according to 29 CFR 1926.55 and .57. Compliance with permissible exposure levels must be demonstrated with a minimum of three (3) consecutive readings taken seven (7) days apart, for each new work task or change in equipment, process, or control measure.

3.3 MECHANICAL REMOVALS

A. Mechanical removals shall consist of dismantling and removing existing pipes, pumps, motors and other facilities as specified, shown, or required for the completion of the work. It shall include cutting, capping, draining, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto will be included under Division 23 of the Specifications.

B. Existing process, water, chemical, and other piping shall be removed where shown on the Contract Drawings. All removed piping shall be removed to the nearest solid support, capped and left in place. Piping shall be purged and made safe by the Contractor prior to removal or capping. Disposal of any chemicals or other purged material shall be the responsibility of the Contractor. Where piping that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.

C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new work or is shown or specified to be removed.

D. Any required demolition or changes to potable water piping and other plumbing system work shall be made in conformance with all applicable codes. Portions of the potable water system that may have been altered or opened shall be pressure tested and disinfected in accordance with the Specifications for Division 22 and local codes. Other plumbing piping and heating piping shall be pressure tested only.

E. Provide all caps, plugs, blind flanges, shut-off valves and other work and materials required to remove from service existing piping and necessary to keep existing piping in service where shown or required.

F. The City reserves the right, at any time and as it alone sees fit, to remove from the scope of the demolition and removals work any of the items specified or indicated to be demolished and removed.

3.4 PAVEMENT, CURB AND SIDEWALK REMOVALS

A. Remove existing pavement, including base and surface courses, stabilized sub-bases, curbs, and gutters as required to construct new facilities or as shown. Before removing, saw a straight joint at least 1-1/2-inches deep between sidewalk and pavement designated for removal and that left in place. Curbs and gutters shall be removed to the nearest construction joint beyond the limit of demolition shown on the Drawings.

B. Provide for satisfactory transition between replaced pavement and sidewalks and the portions remaining in place.

3.5 ELECTRICAL REMOVALS

A. Electrical removals shall consist of the removal of existing generators, transformers, distribution switchboards, control panels, motors, conduits and wires, and miscellaneous electrical equipment all as shown, specified, or required to perform the work.

B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage to keep existing systems in operation and maintain the integrity of the grounding systems.

C. Distribution switchboards shall be removed or modified as shown. Switchboards to be removed shall be disconnected and dismantled, and all components shall be disposed of off the site. Circuit breakers and other control equipment on modified switchboards that will no longer be used shall be removed unless otherwise shown or specified. All new openings cut into the modified switchboard panels shall be cut square and dressed smooth to the dimensions required for the installation of the new equipment.

D. Motors shall be disconnected and removed where shown or specified. Motors not marked or designated by the City or the Commissioner to be salvaged shall be removed from the site. Motors or other electrical gear designated for reuse shall be stored in enclosed, heated storage.

E. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged, turned over to the City and stored where directed by the Commissioner. Abandoned conduits concealed in floor or ceiling slabs, or in

walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.

3.6 MISCELLANEOUS REMOVALS

A. Contractor shall remove miscellaneous items where shown on the Drawings or where necessary for the construction of new structures or modification of existing structures. Anchor bolts shall be cut back one inch below the concrete surface and the hole patched.

3.7 MODIFICATIONS AND CLOSURES

A. Modifications shall conform to all applicable Specifications, the Drawings, and the directions and approvals of the Commissioner.

B. Where alterations require cutting or drilling into existing floors, walls, and roofs, the holes shall be repaired in an approved manner. Contractor shall repair such openings with the same or matching materials as the existing floor, wall, or roof, or as otherwise approved by the Commissioner. All repairs shall be smoothly finished unless otherwise approved by the Commissioner.

C. Openings in existing concrete slabs, ceilings, roofs, masonry walls, floors and partitions which are not to be used in the new work shall be closed and sealed as shown or otherwise directed by the Commissioner.

D. Where parts of existing structures are to remain in service, demolish the portions to be removed, repair damage, and leave the structure in proper condition for the intended use. Remove concrete and masonry to the lines designated by drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp straight corners that will result in neat joints with new construction or be satisfactory for the purpose intended. Where existing reinforcing rods are to extend into new construction, remove the concrete so that the reinforcing is clean and undamaged. Cut off other reinforcing flush with the surface.

E. New work shall be keyed into the existing in an acceptable manner. New reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, the same or matching materials as the existing adjacent surface shall be used. The finished closure shall be a smooth, tight, sealed, permanent closure with all exposed surfaces smooth finished and acceptable to the Commissioner.

3.8 SERVICE AND CLEAN UP

A. Contractor shall maintain the buildings, structures, and other City properties free from accumulations of waste, debris, and rubbish caused by the demolition and removal operations.

B. Contractor shall provide on-site dump containers for collection of waste materials, debris and rubbish, and shall wet down dry materials to prevent blowing dust.

C. At reasonable intervals during the progress of the demolition and removal work or as directed by the Commissioner, Contractor shall clean the Site and properties, and dispose of waste materials, debris, and rubbish.

3.9 REMEDIAL ACTION FOR UNFORESEEN HAZARDOUS MATERIALS

A. Remedial action for unforeseen hazardous materials shall be in accordance with Specification 022423 – Chemical Sampling and Analysis of Soils.

END OF SECTION 024000

SECTION 028013 – GENERAL CONTRACTOR WORK

ALLOWANCE FOR INCIDENTAL ASBESTOS ABATEMENT

1.01 SCOPE FOR ASBESTOS ABATEMENT WORK

A. The "General Conditions" apply to the work of this Section.

B. The Asbestos abatement contractor shall remove asbestos containing materials as needed to perform the other work of this Contract when discovered during the course of work. When required, the Asbestos abatement contractor shall replace the ACM with non-asbestos containing materials. An allowance of **$15,000.00** for the **General Contractor** is herein established for this incidental work when so ordered and authorized by the Commissioner.

C. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF THE RULES AND REGULATIONS OF THE ASBESTOS CONTROL PROGRAM AS PROMULGATED BY TITLE 15 CHAPTER I OF RCNY AND NEW YORK STATE DEPARTMENT OF LABOR INDUSTRIAL CODE RULE 56 CITED AS 12 NYCRR, PART 56 WHICHEVER IS MORE STRINGENT AS PER LATEST AMENDMENTS TO THESE LAWS AND AS MODIFIED HEREIN BY THESE SPECIFICATIONS.

D. ALL DISPOSAL OF ASBESTOS CONTAMINATED MATERIAL SHALL BE PER LOCAL LAW 70/85.

E. THE ASBESTOS ABATEMENT CONTRACTOR'S ATTENTION IS DIRECTED TO THE FACT THAT CERTAIN METHODS OF ASBESTOS ABATEMENT ARE PROTECTED BY PATENTS. TO DATE, PATENTS HAVE BEEN ISSUED WITH RESPECT TO "NEGATIVE PRESSURE ENCLOSURE" OR "NEGATIVE-AIR" OR "REDUCED PRESSURE" AND "GLOVE BAG".

F. THE ASBESTOS ABATEMENT CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR AND SHALL HOLD THE DEPARTMENT OF DESIGN AND CONSTRUCTION AND THE CITY HARMLESS FROM ANY AND ALL DAMAGES, LOSSES AND EXPENSES RESULTING FROM ANY INFRINGEMENT BY THE ASBESTOS ABATEMENT CONTRACTOR OF ANY PATENT, INCLUDING BUT NOT LIMITED TO THE PATENTS DESCRIBED ABOVE, USED BY THE ASBESTOS ABATEMENT CONTRACTOR DURING PERFORMANCE OF THIS AGREEMENT.

G. "Asbestos" shall mean any hydrated mineral silicate separable into commercially usable fibers, including but not limited to chrysotile (serpentine), amosite

(cumingtonite-grunerite), crocidolite (riebeckite), tremolite, anthrophyllite and actinolite.

H. Prior to starting, the Asbestos abatement contractor must notify the Commissioner of the Department of Design and Construction if he/she anticipates any difficulty in performing the Work as required by these Specifications. The Asbestos abatement contractor is responsible to prepare and submit all filings, notifications, etc. required by all City, State and Federal regulatory agencies having jurisdiction.

The Asbestos abatement contractor is responsible for submitting the Asbestos Project Notification Form (ACP-7 Form) to the Department of Environmental Protection, Asbestos Control Program, as per Title 15, Chapter I of RCNY and to the NYSDOL as per Industrial Code Rule 56.

The Asbestos abatement contractor is responsible for preparing, and submitting Asbestos Variance Application (ACP-9). If a Variance is required, the Asbestos abatement contractor is responsible to retain a NYSDOL Asbestos Project Designer, as defined in Title 15, Chapter 1 of the RCNY to prepare and submit the required variance.

The General contractor is responsible for preparing and submitting an Asbestos Abatement Permit and/or Work Place Safety Plans (WPSP) that may be required for the completion of the Contract or incidental work. If such plans are required, the Asbestos abatement contractor is responsible to retain a NYSDOL Licensed Design Professional as defined in Title 15, Chapter 1 of the RCNY to prepare and submit the required plans.

The Asbestos abatement contractor is responsible for the submission of all required documents to the NYCDEP to acquire the appropriate Asbestos Project Conditional Closeout (ACP-20) and/or Asbestos Project Completion Forms (ACP-21) on a timely basis for the completion of the incidental work encountered under this contract.

The Asbestos abatement contractor will be required to attend an on-site job meeting with the Construction Project Manager prior to the start of work to examine conditions and plan the sequence of operations, etc.

The Asbestos abatement contractor shall have a NYSDOL/NYCDEP Asbestos Supervisor onsite to oversee the work and conduct a final visual inspection as required by both Title 15, Chapter 1 of the RCNY and NYSDOL Industrial Code Rule 56.

I. All work shall be done during regular working hours unless the Asbestos abatement contractor requests authorization to work in other then regular working hours and such authorization is granted by the Commissioner. (Regular work hours are those hours during which any given facility, in which work is to be

done, is customarily open and functioning, normally between the hours of 8:00 A.M. and 4:00 P.M. Monday - Friday.) If such work schedule is authorized by the Commissioner, the work shall be done at no additional cost to the City.

J. The Commissioner may order that work be done in other than regular working hours as herein by defined and this order may require the Asbestos abatement contractor to pay premium or overtime wages to complete the work. If the Commissioner orders work in other than regular working hours, the Asbestos abatement contractor shall multiply the unit price for that portion of the work requiring premium wages by 1.50 when computing payment in accordance with Paragraph 1.09. All requests for premium payment must be supported by certified payroll sheets and field sheets approved by the Construction Project Manager.

1.02 QUALIFICATIONS OF ASBESTOS ABATEMENT CONTRACTOR

A. Requirements: The asbestos abatement contractor must demonstrate compliance with the special experience requirements set forth in subparagraphs (1) through (5) below. The asbestos abatement contractor must, submit documentation demonstrating compliance with all listed requirements. Such documentation shall include without limitation, all required licenses, certificates, and documentation.

1. The asbestos abatement contractor must, whether an individual, corporation, partnership, joint venture or other legal entity, must demonstrate for the three year period prior to the work, that it has been licensed by the New York State Department of Labor, as an "Asbestos abatement contractor".

2. The asbestos abatement contractor must, for the three year period prior to the work, have been in the business of providing asbestos abatement services as a routine part of its daily operations.

3. The asbestos abatement contractor proposing to do asbestos abatement work must be thoroughly experienced in such work and must provide evidence of having successfully performed and completed in a timely fashion at least five (5) asbestos abatement projects of similar size and complexity. The aggregate cost of these projects must be at least $250,000.00 in each of the three years.

4. For each project submitted to meet the experience requirements set forth above, the asbestos abatement contractor must submit the following information for the project; name and location of the project; name title and telephone number of the owner or the owner's representative who is familiar with the asbestos abatement contractor's work, brief description of the work completed as a prime or sub-asbestos abatement contractor; amount of contract or subcontract and the date of completion.

5. The asbestos abatement contractor must demonstrate that it has the financial resources, supervisory personnel and equipment necessary to carry out the work and to comply with the required performance schedule, taking into consideration other business commitments. The asbestos abatement contractor must submit such documentation as may be required by the Department of Design and Construction to demonstrate that it has the requisite capacity to perform the required services of this contract.

B. Insurance Requirements: The asbestos abatement contractor must provide asbestos liability insurance in the following amount: 1 million dollars per occurrence, 2 million dollars aggregate (combined single limit). The City of New York shall be named as an additional insured on such insurance policy.

C. Throughout the specifications, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics thereof.

1.03 ASBESTOS ABATEMENT CONTRACTOR RESPONSIBILITIES

The Asbestos abatement contractor will visit the subject location within one (1) working day of notification to ascertain actual work required. If the project is identified as being "urgent", then work shall commence no later than 48 hours from the time of notification. In this event, the asbestos abatement contractor shall immediately notify when applicable EPA NESHAPS Coordinator, NYSDOL Asbestos Control Bureau and NYCDEP Asbestos Control Program of start of the work and file the necessary Asbestos Notifications and any applicable Variance Applications with the regulatory agencies cited above.

In the event that the project is not classified as "urgent" the Asbestos abatement contractor shall notify the EPA NESHAPS Coordinator, NYSDOL and NYCDEP by submitting the requisite asbestos project notification forms, postmarked 10 days before activity begins if 260 linear feet or more and/or 160 square feet or more of asbestos containing material will be disturbed.

The following information must be included in the notification:

A. Name and address of building City or operator;

B. Project description:

1. Size - square feet, number of linear feet, etc;

2. Age - date of construction and renovations (if known);

3. Use - i.e., office, school, industrial, etc.

4. Scope - repair, demolition, cleaning, etc.

C. Amount of asbestos involved in work and an explanation of techniques used to determine the amount;

D. Building location/address, including Block and Lot numbers;

E. Work schedule including the starting and completion dates;

F. Abatement methods to be employed;

G. Procedures for removal of asbestos-containing material;

H. Name, title and authority of governmental representative sponsoring project.

1.04 WORK INCLUDED IN UNIT PRICE

The Asbestos abatement contractor will be paid a basic unit price of **$25.00** per square feet for the removal and disposal of asbestos containing material and replacement of the same with non-asbestos containing materials.

Unit price shall include all costs necessary to do the work of this Contract, including but not limited to: labor, materials, equipment, utilities, disposal, insurance, overhead and profit.

1.05 AIR MONITORING – ASBESTOS ABATEMENT CONTRACTOR

A. "Air Sampling" shall mean the process of measuring the fiber content of a known volume of air collected during a specific period of time. The procedure utilized for asbestos follows the N1OSH Standard Analytical Method 7400 or the provisional transmission electron microscopy methods developed by the USEPA and/or National Institute of Standard and Technology which are utilized for lower detectability and specific fiber identification.

B. Air monitoring of Asbestos abatement contractor's personnel will be performed in conformance with OSHA requirements, (All costs associated with this work are deemed included in the unit price.).

C. Qualifications of Testing Laboratory:

The industrial hygiene laboratory shall be a current proficient participant in the American Industrial Hygiene Association (AIHA) PAT Program. The laboratory identification number shall be submitted and approved by the City. The laboratory shall be accredited by the AIHA and New York State Department of Health Environmental Laboratory Approval Program (ELAP).

Note: Work area air testing and analysis before, during and upon completion of work (clearance testing) will be performed by a Third Party Air Monitor under separate Contract with the City.

1.06 THIRD PARTY MONITORING AND LABORATORY

A. The NYCDDC, at its own expense, will employ the services of an independent Third Party Air Monitoring Firm and Laboratory. The Third Party Air Monitor will perform air sampling activities and project monitoring at the Work Site.

B. The Laboratory will perform analysis of air samples utilizing Phase Contrast Microscopy (PCM) and/or Transmission Electron Microscopy (TEM).

C. The Third Party Air Monitoring Firm and the designated Project Monitor shall have access to all areas of the asbestos removal project at all times and shall continuously inspect and monitor the performance of the Asbestos abatement contractor to verify that said performance complies with this Specification. The Third-Party Air Monitor shall be on site throughout the entire abatement operation.

D. The NYCDDC will be responsible for costs incurred with the Third Party Air Monitoring Firm and laboratory work. Any subsequent additional testing required due to limits exceeded during initial testing shall be paid for by the Asbestos abatement contractor.

1.07 PAYMENT REQUEST DOCUMENTATION

B. The following information shall be included for each payment request:

1. Description of work performed.
2. Linear footage and pipe sizes involved.
3. Square footage for boiler & breaching insulation removed.
4. Square footage of non pipe and boiler areas removed, patched, enclosed, sealed, or painted.
5. Square footage of encapsulation, sealing, patching, and painting involved.
6. Total cost associated with compliance with the assigned task.
7. Architectural, Electrical, HVAC, Plumbing, etc. work incidental to the Asbestos Abatement Work.
8. A certified copy (in form 4312-39) to the Comptroller or Financial Officer of the New York City to the effect that the financial statement is true.

9. A signed copy (in form 6506q-6) of certificate of compliance with non-discriminatory provisions of the Contract.

10. Attach a copy of valid workmen compensation insurance.

11. Valid asbestos insurance per occurrence.

12. General liability insurance when required.

C. Each payment request shall include a grand total for all work completed that billing period, the landfill waste manifests and a copy of waste transporter permit. The Department of Design and Construction will inspect the work performed, review the cost and approve or disapprove requests for payment.

D. EXPOSURE LOG: With this final payment, the Asbestos abatement contractor shall submit a listing of the names and social security numbers of all employees actively engaged in the abatement work of this Contract. This list shall include a summary showing each part of the abatement work in which the employee was engaged and the dates thereof.

1.08 QUANTITY CALCULATIONS

In order to determine the square footage involved for the various pipe sizes of pipe insulation that might be encountered, the following table is to be used.

PIPE INSULATION SIZE O.D.	PIPE SIZE O.D.	SQUARE FOOTAGE PER LINEAR FOOT
2-1/2"	1/2"	0.65
2-3/4"	3/4"	0.72
3"	1"	0.79
3-1/4"	1-1/4"	0.85
3-1/2"	1-1/2"	0.92
4"	2"	1.05
4-1/2"	2-1/2"	1.18
5"	3"	1.31
6"	3-1/4"	1.57
7"	3-1/2"	1.83
8"	4"	2.09
9"	5"	2.36
10"	6"	2.62
12"	8"	3.14
14"	10"	3.67
16"	12"	4.19
18"	14"	4.71

1.09 METHOD OF PAYMENT

Payment shall be made in accordance with Items A through R below. Payment shall be calculated based on the actual quantity of the item performed by the asbestos abatement contractor, times the unit price specified below. Credits may apply to certain times, as specified below.

A. **REMOVAL, DISPOSAL AND REPLACEMENT OF ASBESTOS CONTAINING PIPE INSULATION:** Actual linear footage, multiplied by the square footage factor listed for the respective pipe size in Section 1.08, multiplied by the unit price in Section 1.04.

EXAMPLE: 100 lin.ft. of 1/2" pipe and 100 lin.ft. of 6" pipe, including elbows, tees. Flanges, etc.

100 X 0.65 = 65 sq.ft. 65 x unit price = Payment

100 X 2.62 = 262 sq.ft. 262 x unit price = Payment

B. **REMOVAL, DISPOSAL AND REPLACEMENT OF BOILER INSULATION:** (all types including Silicate Block and including the removal/replacement of metal jacketing) Payment shall be made at 1.5 times the unit price per square foot.

EXAMPLE: Item B. removal and replacement of 1000 S.F. of boiler insulation (incl. Silicate block)

1000 S.F. X (1.5) X the Unit Price = Payment

C. **REMOVAL, DISPOSAL AND REPLACEMENT OF TANK INSULATION:** (all types including removal/replacement of metal jacketing) Payment shall be made at 1.5 times the unit price per square foot.

D. **REMOVAL, DISPOSAL AND REPLACEMENT OF BOILER UPTAKE, & BREACHING INSULATION:** (all types including stiffening angles and wire lath) Payment shall be made at 2.0 times the unit price per square foot.

E. **REMOVAL, DISPOSAL AND REPLACEMENT OF DUCT INSULATION:** Payment shall be made at 1.0 times the unit price per square foot.

F. **REMOVAL, DISPOSAL AND REPLACEMENT OF SOFT ASBESTOS CONTAINING MATERIAL:** (Including sprayed-on fire proofing and sound proofing) Payment shall be made at 1.0 times the unit price per square foot of surface area. Area of irregular surfaces must be calculated and confirmed with DDC representative.

G. **ACOUSTIC PLASTER REPAIR AND/OR ENCAPSULATION:** Payment shall be made at 0.5 times the unit price per square foot.

H. **PATCHING OR REPAIR** of items listed in A through F will be paid at 0.33 times the unit price per square foot.

I. **REMOVAL, DISPOSAL AND REPLACEMENT OF WATERPROOFING ASBESTOS CONTAINING MATERIAL:** (including friable and non-friable waterproofing material from interior and exterior walls, floors, foundations, penetrations, louvers, vents and openings other than windows, doors and skylights) Payment shall be made at 0.5 times the unit price per square foot.

J. **REMOVAL, DISPOSAL AND REPLACEMENT OF ASBESTOS CONTAINING ELECTRICAL WIRING INSULATION:** (including friable and non-friable wiring insulation) Payment shall be made at 0.33 times the unit price per square foot.

K. **PAINTING:** Payment shall be made at 0.05 times the unit price per square foot.

L. **REMOVAL AND DISPOSAL OF ASBESTOS-CONTAINING PLASTER:** from ceilings and walls, including any wire lath and disposal as asbestos containing waste. Payment shall be made at 0.80 times the unit price per square foot.

M. **REMOVAL AND DISPOSAL OF ASBESTOS-CONTAINING FLOOR TILES, CEILING TILES, TRANSITE PANELS:** (including any adhesive, glue, mastic and/or underlayment) and disposal as asbestos containing waste. Payment shall be made at 0.40 times the unit price per square foot. If multiple layers are discovered, each additional layer shall be paid at 0.20 times the unit price per square foot.

N. **ADDITIONAL CLEAN UP/HOUSEKEEPING OF WORK AREA:** (excluding pre-cleaning of work area required by regulations) HEPA vacuuming and wet cleaning of asbestos contaminated surface. Payment shall be made at 0.20 times the unit price per square foot. When GLOVE BAG is employed to remove ACM, cost of HEPA vacuuming and wet cleaning of floor area up to 3 feet on each side of glove-bag shall be included in unit price and no extra payment will be made.

O. **REMOVAL, DISPOSAL OF ASBESTOS-CONTAINING ROOFING MATERIAL:** including mastic, flashing and sealant compound and provide temporary asbestos-free roof covering consisting of one layer of rolled roofing paper sealed with asphaltic roofing compound. Payment shall be made at 0.8 times the unit price per square foot. Credit at a rate of 0.33 times the unit price will be taken for each square foot of temporary roof covering which the Asbestos abatement contractor is directed not to install.

P. **PICK-UP AND DISPOSAL OF GROSS DEBRIS:** (excluding any waste generated from abatement under Item A-R) at a rate of $150 per cubic yard for

asbestos contaminated waste and $75 per cubic yard for non-asbestos contaminated waste. This cost includes all labor and material cost associated with work.

Q. **REMOVAL OF ASBESTOS-CONTAINING BRICK, BLOCK, MORTAR, CEMENT OR CONCRETE:** along with all surfacing materials including wire lath and/or other supporting structures and disposal as ACM waste. Payment shall be made at a rate of $25.00 per cubic foot of material removed.

R. **REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING WINDOW/DOOR CAULKING:** including friable and non-friable caulking, weather-stripping, glazing, sealants or other waterproofing materials applied to windows, doors, skylights, etc. Payment shall be made at the rate of $400.00 per opening regardless of size or configuration. This cost includes labor, consumable materials, set-up/breakdown, removal and disposal, as required.

Note 1: CREDIT: For items listed in A through F, a credit at a rate of 0.33 times the unit price, times the respective multiplier (for each item) will be taken for each square foot of insulation which the asbestos abatement contractor is not directed to reapply.

Note 2: MINIMUM PAYMENT: The minimum payment per call at any individual job sites or various job sites during the same day will be eight hundred dollars ($800.00).

Note 3: All payments shall be made as described in paragraph 1.09 herein.

Note 4: WORKING HIGHER THAN 12 FEET ABOVE FLOOR LEVEL OR WORK REQUIRING COMPLEX SCAFFOLDING OR CONSTRUCTION WORK PLATFORMS: Provisions are made in this Contract to compensate the Asbestos abatement contractor for work performed in locations that are difficult to access due to work at elevations that are significantly higher than the normal work level. The unit price for these items will be paid at 1.20 times the unit price described in Paragraphs 1.09, A through R for those portions of the work that are more than twelve (12) feet above the grade for that would be judged as the normal working level.

1.10 GUARANTEE

A. Work performed in compliance with each task shall be guaranteed for a period of one year from the date the completed work is accepted by the Department of Design and Construction.

B. The Commissioner of The Department of Design and Construction will notify the Asbestos abatement contractor in writing regarding defects in work under the guarantee.

1.11 OCCUPANCY OF SITE NOT EXCLUSIVE

Attention is specifically drawn to the fact that contractors, performing the work of other Contracts, may be brought upon any of the work sites of this Contract. Therefore, the Asbestos abatement contractor shall not have exclusive rights to any site of his work and shall fully cooperate and coordinate his work with the work of other contractors who may be brought upon any site of the work of this Contract. This paragraph applies to those areas outside the regulated Work Area as defined by Title 15, Chapter I of RCNY.

1.12 SUBMITTALS

A. Pre-Construction Submittals:

1. Attend a pre-construction meeting scheduled by the City of New York Department of Design and Construction. This meeting shall also be attended by a designated representative of the City of New York third party air monitoring firm, facility manager and the Construction Project Manager. At this meeting, the Asbestos abatement contractor shall present three copies of the following items:
   a. Asbestos abatement contractor's scope of work, work plan and schedule.

   b. Asbestos project notifications, approved variances and plans to Government Agencies.

   c. Copies of Permits, clearance and licenses if required.

   d. Schedules: the Asbestos abatement contractor shall provide to the Construction Project Manager a copy of the following schedules for approval. Once approved, schedules shall be maintained and updated as received. Asbestos abatement contractor shall post a copy of all schedules at the site:

      (1) A construction schedule stating critical dates of the project including, but not limited to, mobilization, Work Area preparation, demolition, gross removal, fine cleaning, encapsulation, inspections, clearance monitoring, and phase of refinishing and final inspections. The schedule shall be updated biweekly, at a minimum.

      (2) A schedule of staffing stating number of workers per shift per activity, name and number of supervisor(s) per shift, shifts per day, and total days to be worked.

      (3) Submit all changes in schedule or staffing to the Construction Project Manager prior to implementation.

e. Written description of emergency procedures to be followed in case of injury or fire. This section must include evacuation procedures, source of medical assistance (name and telephone number to nearest hospital) and procedures to be used for access by medical personnel (examples: first aid squad and physician). NOTE: Necessary Emergency Procedures Shall Take Priority Over All Other Requirements of These Specifications.

f. Safety Data Sheets (SDS) for encapsulants, sealants, firestopping foam, cleaners/disinfectants, spray adhesive and any and all potentially hazardous materials that may be employed on the project. No work involving the aforementioned will be allowed to proceed until SDS are reviewed.

g. Worker Training and Medical Surveillance: The Asbestos abatement contractor shall submit a list of the persons who will be employed by him /her to perform the removal work. Present evidence that workers have received proper training required by the regulations and the medical examinations required by OSHA 29 CFR 1926.1101.

h. Logs: Specimen copies of daily progress log, visitor's log, and disposal log.

(1) The Asbestos abatement contractor shall provide a permanently bound log book of minimum 8-1/2" x 11" size at the entrance to the Worker and Waste Decontamination enclosure system as hereinafter specified. Log book shall contain on title page the project name, name, address and phone number of the Asbestos abatement contractor; name, address and phone number of Asbestos abatement contractor and City's third party air monitoring firm; emergency numbers including, but not limited to local Fire/Rescue Department. Log book shall contain a list of personnel approved for entry into the Work Area.

(2) All entries into the log shall be made in non-washable, permanent ink and such pen shall be strung to or otherwise attached to the log to prevent removal from the log-in area. Under no circumstances shall pencil entries be permitted. Any significant events occurring during the abatement project shall be entered into the log. Upon completion of the job, the Asbestos abatement contractor shall submit the logbook containing a day-to-day record of personnel log entries countersigned by the Construction Project Manager every day.

i. Worker's Acknowledgments: Submit statements signed by each employee that the employee has received training in the proper handling of ACM, understands the health implications and risks involved; and understands the use and limitations of the respiratory equipment to be used.

B. During Construction Submittals:

1. Security and safety logs showing names of person entering workspace, date and time of entry and exit, record of any accident, emergency evacuation, and any other safety and/or health incident.

2. Progress logs showing the number of workers, supervisors, hours of work and tasks completed shall be submitted daily to the Construction Project Manager.

3. Floor plans indicating Asbestos abatement contractor's current work progress shall be submitted for review by the Construction Project Manager.

4. All Asbestos abatement contractors' air monitoring and inspection results.

C. Project Closeout Submittals:

Upon completion of the project and as a condition of acceptance, the Asbestos abatement contractor shall present two copies of the following items, bound and indexed:

1. Lien Waivers from Asbestos abatement contractor, Sub-Asbestos abatement contractors and Suppliers,

2. Daily OSHA air monitoring results,

3. All Waste Manifests (Asbestos and Construction Debris), seals and disposal logs,

4. Field Sign-In/Sign-Out Logs for every shift,

5. Copies of all Building Department Forms and Permits,

6. A Letter of Compliance stating that all the work on this project was performed in accordance with the Specifications and all applicable Federal, State and Local regulations,

7. All Warranties as stated in the Specifications,

   a. Fully executed disposal certificates and transportation manifest.

8. Project Record: The Asbestos abatement contractor shall maintain a project record for all small and large asbestos projects. During the project, the project record shall be kept on site at all times. Upon completion of the project, the project record shall be maintained by the building owner. The project record shall be submitted to DDC as part of the close out documents. The project record shall consist of:

   a. Copies of licenses of all asbestos abatement contractors involved in the project;

   b. Copies of NYCDEP and NYSDOL supervisor and handler certificates for all workers engaged in the project;

   c. Copies of all project notifications and reports filed with NYCDEP, NYSDOL and USEPA for the project, with any amendments or variances;

   d. Copies of all asbestos abatement permits, including associated approved plans and work place safety plan;

   e. A copy of the air sampling log and all air sampling results;

   f. A copy of the abatement asbestos abatement contractor's daily log book;

   g. Copies of all asbestos waste manifests;

   h. A copy of all Project Monitor's Reports (ACP-15).

   i. A copy of each ATR-1 Form completed for the asbestos project (if required).

   j. A copy of each Asbestos Project Conditional Closeout Report (ACP-20) if required.

   k. A copy of the Asbestos Project Completion Form (ACP-21).

1.13 PROTECTION OF FURNITURE AND EQUIPMENT

Cover all furniture and equipment that cannot be removed from Work Areas. Movable furniture and equipment will be removed from Work Areas by the Asbestos abatement contractor prior to start of work. At the conclusion of the work (after final air testing), the Asbestos abatement contractor will remove all plastic covering on walls, floors, furniture, equipment and reinstall furniture and equipment. He shall remove and store all sheaths, curtains and drapes, and reinstall same following final clean up.

1.14 UTILITIES

A. General:

All temporary facilities shall be subject to the approval of the Commissioner. Prior to starting work at any site, locations and/or sketches (if required) of temporary facilities must be submitted to the Construction Project Manager for the required approval.

B. Water:

The Department of Design and Construction will furnish all water needed for construction, at no cost to the Asbestos abatement contractor in buildings under their jurisdiction. However, it is the responsibility of the Asbestos abatement contractor to ensure that hot water is provided for showering in the decontamination unit. The Asbestos abatement contractor shall furnish, install and maintain any needed equipment to meet these requirements at his own expense.

C. Electricity:

The Department of Design and Construction will furnish all electricity needed for construction, at no cost to the Asbestos abatement contractor in a building, under their jurisdiction. The Asbestos abatement contractor is responsible for routing the electric power to the abatement Work Area.

All temporary lighting and temporary electrical service for Work Area shall be in weatherproof enclosures and be ground fault protected.

D. In leased spaces, arrangements for water supplies and electricity must be made with the landlord. However, all such arrangements must be made through and are subject to approval of the Department of Design and Construction. Utilities will be provided at no cost to the Asbestos abatement contractor. However, it is the Asbestos abatement contractor's (or the General contractor's) responsibility to furnish and install a suitable distribution system to the Work Area. This system will be provided at no cost to the City.

1.15 FEES

The Asbestos abatement contractor shall be responsible for any and all fees or charges imposed by Local, State or Federal Law, Rule and Regulation applicable to the work specified herein, including fees or charges which may be imposed subsequent to the date of the Bid opening.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Concrete toppings.
6. Building frame members.
7. Building walls.
8. Concrete Weir walls
9. Concrete bench base

B. Related Sections:
1. DDC General Conditions
2. Section 034100 – Structural Pre-Cast Concrete
3. Section 034500 – Architectural Pre-Cast Concrete
4. Section 063000 – Wood Benches
5. Section 071326 – Sheet Membrane Waterproofing
6. Section 071413 – Fluid Membrane Waterproofing
7. Section 321313 – Cast in Place Concrete Paving
8. Section 321314 – Cast in Place Concrete Paving – Pervious
9. Section 321613 - Concrete Curbs and Gutters

1.3 REFRENCES

A. New York City Building Code, 1968

B. American Concrete Institute (ACI)
1. ACI 117 – Specification for Tolerance for Concrete Construction and Materials and Commentary
2. ACI 301 – Specification for Structural Concrete
3. ACI 318 – Building Code Requirement for Structural Concrete

4. ACI 360 – Guide to Design of Slabs on Ground

C. National Institute of Standards and Technology (NIST)
1. Voluntary Product Standard PS 1-09 – Structural Plywood

1.4 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Commissioner.

F. Shop Drawings for Weir walls for Commissioner's approval.
1. Show dimension and locations of weir walls alongside nearby structures, utilities. Provide detailed documentation of any unforeseen below or above ground conditions such as rock.
2. Show layout and details of the formwork, including mockups. Show layout of all form joints, construction and expansion joints, tie locations and exposed embedments. Show details of shop assembly of formwork and field assembly of construction and control joints, reveals, recesses, embedments, ties, reinforcement, and the means to be used to tightly seal all joints and maintain alignment.

G. Shop Drawings for Concrete Bench Base for Commissioner's approval.
1. Show dimension and locations of concrete bench base, including fabrication, placement, and support of concrete reinforcement, and location of proposed construction joints. Shop

drawings will show all locations of proposed concrete bench base with wood timber seat in relation to other built and proposed work, including but not limited to: buildings, walls, curbs, utilities, signage, hydrants, bike racks, etc., as measured on site. Comply with CRSI Manual Of Standard Practice and ACI Sp66.

2. Show layout and details of the formwork, including mockups. Show layout of all form joints, construction joints, tie locations and exposed embedments. Show details of shop assembly of formwork and field assembly of construction joints, reveals, recesses, embedments, ties, reinforcement, and the means to be used to tightly seal all joints and maintain alignment.

H. Samples:
   1. For water-stops.
   2. Concrete Weir Walls : Samples of pigmented concrete with finishes as described herein
      a) Sample size: 12" x 12" x 1" minimum thickness , with 1 sample per finish option
      b) Use specified form material
      c) Finish with specified treatments.
      d) Damage 2"x2" area with electric hammer and test patch for continuity of surface.
      e) Submit as required to attain approval of the Commissioner.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Water-stops.
   7. Curing compounds.
   8. Floor and slab treatments.
   9. Bonding agents.
   10. Adhesives.
   11. Vapor retarders.
   12. Semi-rigid joint filler.
   13. Joint-filler strips.
   14. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

   1. Aggregates.

   2. Design Mix:
      a) Form TR3: Technical Report Concrete Mix Design - The contractor shall be responsible for, and bear all costs associated with the filing and securing of

approvals, if any, for Form TR3: Technical Report Concrete Design Mix, including, but not limited to, engaging the services of a New York City licensed Concrete Testing Lab for the review and approval of concrete design mix, testing, signatures and professional seals, etc., compliant with NYC Department of buildings requirements for each concrete design mix.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of pre-installation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
   1. Concrete Weir Walls:
      a) Installer Qualifications: An experienced installer who has completed successful projects in the last 3 years similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
      b) Installers' Field Supervision: Require installer to maintain an experienced full-time supervisor on the Project Site during times cast-in-place concrete installation is in progress.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 200 sq. ft. (18.6 sq. m) for slab-on-grade and 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Mockups: Concrete Weir Walls

1. Cast mockup of full size sections of pigmented concrete weir wall to demonstrate typical joints, surface finish, texture, color, and standard of workmanship. Build mock-ups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, expansion joints, and contiguous Work as indicated
   a) Notify Construction Manager and Commissioner seven days in advance of dates and times when mockups will be constructed.
   b) Obtain Construction Manager and Commissioner's approval of the dimensions, finish, texture, color, joints and edge condition to be shown within mockup before starting construction.
   c) Build full size wall mockup full height, full width, to nearest expansion joint.
      1) Contractor has the option for the mockup to be built full height full width x 4' length, with the understanding that a mockup that does not extend to the expansion joint shall not be incorporated into the final work.
   d) The mockup shall be incorporated into the final work only if approved. If mock-up is not approved, another mock-up will be required.
   e) Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed work.

J. Mockups: Concrete Bench Base with Wood Timber Seat Assembly

1. Notify Construction Manager and Commissioner seven days in advance of dates and times when mockups will be constructed.
2. Obtain Construction Manager and Commissioner's approval of the dimensions, finish, texture, color, joints and edge condition to be shown within mockup before starting construction.
3. Construct three mockups (12" Height with finish on exposed surface by 48" Length by 8" depth) samples of concrete with a plywood or lumber Smooth Formlined Finish. Wire brush the board form prior to pouring the concrete. Use same type of board form material that will be used for the final installation. The three mockups will consist of a light, medium and heavy wire brush Smooth Formlined Finish for approval by the Commissioner.
4. Build full size bench assembly which consists of the concrete bench base with approved Smooth Formlined Finish and wood timber seat assembly at full height and width.
   a) The mockup shall be incorporated into the final work only if approved.
   b) If mock-up is not approved, another mock-up will be required.

5. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed work.

K. Staking/Layout: Completely stake/layout areas and locations of cast-in-place concrete to demonstrate locations and extent of features. Stake/layout to comply with the following requirements:
   1. Notify Construction Manager 48 hours in advance of dates and times when layouts will be constructed and completed.
   2. Obtain Construction Manager's written approval of layouts before proceeding with Work (i.e., constructing formwork).
   3. Progressively maintain and protect approved layouts in an undisturbed condition as formwork is progressively installed.

L. Formwork Layout: Construct formwork for cast-in-place concrete bench base to demonstrate locations and extent of features. Construct formwork to comply with the following requirements, using materials indicated for the completed Work.
   1. Notify Construction Manager 48 hours in advance of dates and times when formwork will be constructed and completed.
   2. Obtain Construction Manager's written approval of formwork before proceeding with Work (i.e., constructing formwork).
   3. Progressively maintain and protect approved formwork in an undisturbed condition as concrete is progressively placed.

M. Control Joint Layout: Completely layout and mark on formwork with indelible marking material control joint locations for concrete bench base prior to placing concrete. Layout shall comply with the following requirements.
   1. Notify Construction Manager 48 hours in advance of dates and times when jointing layouts will be performed and completed.
   2. Obtain written approval of jointing layouts by Construction Manager before proceeding with cutting control joints

N. Pre-installation Conference: Conduct conference at Project site.

   1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

      a) Contractor's superintendent.
      b) Independent testing agency responsible for concrete design mixtures.
      c) Ready-mix concrete manufacturer.
      d) Concrete subcontractor.
      e) Special concrete finish subcontractor.

   2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.8 LEED PERFORMANCE REQUIREMENTS

A. See section 2.13 for minimum Performance requirements of the concrete mixtures. The Cast-in place concrete shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Section 018113 Sustainable Design Requirements.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Section 018113 Sustainable Design Requirements, where applicable.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Water-stops: Store water-stops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with NIST Voluntary Product Standard PS 1-09, and as follows:

    a) High-density overlay, Class 1 or better.
    b) Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    c) Structural 1, B-B or better; mill oiled and edge sealed.
    d) B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
3. Smooth-formlined finish: As-cast finish using smooth flat form surfaces:
    a) A smooth-faced Rigid Polymer formliner in sizes to cover surface areas as shown on the drawings.
    b) Plastic coated, birch plywood, minimum 14 plies per inch, ¾" thick panels in sizes to cover surface areas shown on the drawings. Panels shall be Finn Form (Red) distributed by Plywood & Door Corp, Union, NJ or approved equal.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding

specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.
4. For the Concrete Weir walls, the intent is to have tie-hole joints that are aligned within 1/4" maximum tolerance.
   a) Tie holes to be evenly spaced and located 6" min from the edge of the formwork.
   b) The location of the tie-hole joints is to be as per the approved shop drawings.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed for bars less than or equal #7 (<= #7). ASTM A 615/A 615M, Grade 75 (Grade 520), deformed for bars greater than or equal #8 (>= #8).

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 615/A 615M, Grade 75 (Grade 520), ASTM A 706/A 706M, deformed bars, ASTM A 767/A 767M, Class I zinc coated after fabrication and bending.

E. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420) or ASTM A 615/A 615M, Grade 75 (Grade 520), ASTM A 706/A 706M, deformed bars,

ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

F. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420) ASTM A 706/A 706M, deformed bars, assembled with clips.

G. Plain-Steel Wire: ASTM A 82/A 82M, galvanized.

H. Deformed-Steel Wire: ASTM A 496/A 496M.

I. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain steel wire, with less than 2 percent damaged coating in each 12-inch (300-mm) wire length.

J. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

K. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

L. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.

M. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland cement: ASTM C 150, Type I, Type II, Type I/II, gray. Supplement with the following:

   a) Fly Ash: ASTM C 618, Class F or C.
   b) Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag Type IP, portland-pozzolan Type I (PM), pozzolan-modified portland Type I (SM), slag-modified portland cement.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, coarse aggregate. Aggregate class to be equal to or better then listed in Table 3 or ASTM C33 for that particular component. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C 330, 1/2-inch (13-mm) nominal maximum aggregate size.

E. Water: ASTM C1602 Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a) Axim Italcementi Group, Inc.; CATEXOL CN-CI.
    b) BASF Construction Chemicals - Building Systems; Rheocrete CNI.
    c) Euclid Chemical Company (The), an RPM company; ARRMATECT EUCON BCN EUCON CIA.
    d) Grace Construction Products, W. R. Grace & Co.; DCI.
    e) Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a) BASF Construction Chemicals - Building Systems; Rheocrete 222+.
    b) Cortec Corporation; MCI- 2000 2005NS.
    c) Grace Construction Products, W. R. Grace & Co.; DCI-S.
    d) Sika Corporation; FerroGard 901.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a) ChemMasters.
    b) Davis Colors.
    c) Dayton Superior Corporation.
    d) Hoover Color Corporation.
    e) Lambert Corporation.
    f) QC Construction Products.
    g) Rockwood Pigments NA, Inc.
    h) Scofield, L. M. Company.
    i) Solomon Colors, Inc.

2. Color: As indicated by manufacturer's designation. Match Commissioner's sample. As selected by Commissioner from manufacturer's full range.

F. Concrete Weir Walls
1. Cement: White Cement; Portland Cement: White Cement - Lehigh Portland/Type I/II ASTM C150.

G. Concrete Bench Base
1. Cement: White Cement; Portland Cement: White Cement - Lehigh Portland/Type I/II ASTM C150.

2.6 WATERSTOPS

A. Self-Expanding Rubber Strip Water-stops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
b) Greenstreak; Hydrotite.
c) Vinylex Corp.; Swellseal.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum perm rating of. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
b) Fortifiber Building Systems Group; Moistop Ultra 15.
c) Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
d) Insulation Solutions, Inc.; Viper VaporCheck 16.
e) Meadows, W. R., Inc.; Perminator 15 mil.
f) Raven Industries Inc.; Vapor Block 15.
g) Reef Industries, Inc.; Griffolyn Type-105 Type-65G 15 mil Green.
h) Stego Industries, LLC; Stego Wrap 15 mil Class A.

B. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Fortifiber Building Systems Group; Moistop Ultra 6.
b) Raven Industries Inc.; Griffolyn Type-65 10 mil Green.
c) Stego Industries, LLC; Stego Wrap, 10 mil Class A.

C. Sheet Vapor Retarder: ASTM E 1745, Class C. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Fortifiber Building Systems Group; Moistop Plus.
b) Raven Industries Inc.; Vapor Block 6.
c) Reef Industries, Inc.; Griffolyn Type-65 Type-85.
d) Stego Industries, LLC; Stego Wrap, 10 mil Class C.

D. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

E. Bituminous Vapor Retarder: 110-mil- (2.8-mm-) thick, semi-flexible, 7-ply sheet membrane consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weather-coating, and removable plastic release liner. Furnish manufacturer's accessories including bonding asphalt, pointing mastics, and self-adhering joint tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

a) Meadows, W. R., Inc.; Premoulded Membrane Vapor Seal.

b) Grace; Flurprufe 120

c) Henry; Blueskin WP200

2. Water-Vapor Permeance: 0.00 grains/h x sq. ft. x inches Hg (0.00 ng/Pa x s x sq. m); ASTM E 154.
3. Tensile Strength: 140 lbf/inch (24.5 kN/m); ASTM E 154.
4. Puncture Resistance: 90 lbf (400N); ASTM E 154.

F. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

G. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

H. SC-03 (as indicated in contract drawings) Clear Water Resistant Coating – Applied to above grade CIP structural walls supporting the stone veneer cladding. Location – Above grade concrete walls at Clubhouse.
1. Scofield Repello
2. Approved Equal

2.8 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch (9.5-mm) No. 4 (4.75-mm) No. 8 (2.36-mm) sieve.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Anti-Hydro International, Inc.; Emery.
b) Dayton Superior Corporation; Emery Tuff Non-Slip.

c) Lambert Corporation; EMAG-20.
d) L&M Construction Chemicals, Inc.; Grip It.
e) Metalcrete Industries; Metco Anti-Skid Aggregate.

B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Anti-Hydro International, Inc.; A-H Alox.
b) BASF Construction Chemicals - Building Systems; Frictex NS.
c) L&M Construction Chemicals, Inc.; Grip It AO.

C. Emery Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

1. Color: As selected by Commissioner from manufacturer's full range.

D. Metallic Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.

1. Color: As selected by Commissioner from manufacturer's full range.

E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) BASF Construction Chemicals - Building Systems; Maximent.
b) ChemMasters; ConColor.
c) Conspec by Dayton Superior; Conshake 500.
d) Dayton Superior Corporation; Quartz Tuff.
e) Edoco by Dayton Superior; Burke Non Metallic Floor Hardener 250.
f) Euclid Chemical Company (The), an RPM company; Surflex.
g) Kaufman Products, Inc.; Tycron.
h) Lambert Corporation; Colorhard.
i) L&M Construction Chemicals, Inc.; Quartzplate FF.
j) Metalcrete Industries; Floor Quartz.
k) Scofield, L. M. Company; Lithochrome Color Hardener.
l) Symons by Dayton Superior; Hard Top.

F. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a) ChemMasters; Chemisil Plus.
    b) ChemTec Int'l; ChemTec One.
    c) Conspec by Dayton Superior; Intraseal.
    d) Curecrete Distribution Inc.; Ashford Formula.
    e) Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
    f) Edoco by Dayton Superior; Titan Hard.
    g) Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
    h) Kaufman Products, Inc.; SureHard.
    i) L&M Construction Chemicals, Inc.; Seal Hard.
    j) Meadows, W. R., Inc.; LIQUI-HARD.
    k) Metalcrete Industries; Floorsaver.
    l) Nox-Crete Products Group; Duro-Nox.
    m) Symons by Dayton Superior; Buff Hard.
    n) US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
    o) Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

H. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a) Advanced Floor Products; Retro-Plate 99.
    b) L&M Construction Chemicals, Inc.; FGS Hardener Plus.
    c) QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a) Axim Italcementi Group, Inc.; CATEXOL CimFilm.
    b) BASF Construction Chemicals - Building Systems; Confilm.
    c) ChemMasters; SprayFilm.
    d) Conspec by Dayton Superior; Aquafilm.
    e) Dayton Superior Corporation; Sure Film (J-74).
    f) Edoco by Dayton Superior; BurkeFilm.
    g) Euclid Chemical Company (The), an RPM company; Eucobar.
    h) Kaufman Products, Inc.; Vapor-Aid.
    i) Lambert Corporation; LAMBCO Skin.
    j) L&M Construction Chemicals, Inc.; E-CON.
    k) Meadows, W. R., Inc.; EVAPRE.

l) Metalcrete Industries; Waterhold.
m) Nox-Crete Products Group; MONOFILM.
n) Sika Corporation; SikaFilm.
o) SpecChem, LLC; Spec Film.
p) Symons by Dayton Superior; Finishing Aid.
q) TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r) Unitex; PRO-FILM.
s) Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b) BASF Construction Chemicals - Building Systems; Kure 200.
c) ChemMasters; Safe-Cure Clear.
d) Conspec by Dayton Superior; W.B. Resin Cure.
e) Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
f) Edoco by Dayton Superior; Res X Cure WB.
g) Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
h) Kaufman Products, Inc.; Thinfilm 420.
i) Lambert Corporation; AQUA KURE - CLEAR.
j) L&M Construction Chemicals, Inc.; L&M Cure R.
k) Meadows, W. R., Inc.; 1100-CLEAR.
l) Nox-Crete Products Group; Resin Cure E.
m) Right Pointe; Clear Water Resin.
n) SpecChem, LLC; Spec Rez Clear.
o) Symons by Dayton Superior; Resi-Chem Clear.
p) TK Products, Division of Sierra Corporation; TK-2519 DC WB.
q) Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) Anti-Hydro International, Inc.; AH Clear Cure WB.
b) BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
c) ChemMasters; Safe-Cure & Seal 20.

d) Conspec by Dayton Superior; Cure and Seal WB.
e) Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
f) Dayton Superior Corporation; Safe Cure and Seal (J-18).
g) Edoco by Dayton Superior; Spartan Cote WB II.
h) Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
i) Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
j) Lambert Corporation; Glazecote Sealer-20.
k) L&M Construction Chemicals, Inc.; Dress & Seal WB.
l) Meadows, W. R., Inc.; Vocomp-20.
m) Metalcrete Industries; Metcure.
n) Nox-Crete Products Group; Cure & Seal 150E.
o) Symons by Dayton Superior; Cure & Seal 18 Percent E.
p) TK Products, Division of Sierra Corporation; TK-2519 WB.
q) Vexcon Chemicals, Inc.; Starseal 309.

G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) BASF Construction Chemicals - Building Systems; Kure-N-Seal W.
b) ChemMasters; Safe-Cure Clear.
c) Conspec by Dayton Superior; High Seal.
d) Dayton Superior Corporation; Safe Cure and Seal (J-19).
e) Edoco by Dayton Superior; Spartan Cote WB II 20 Percent.
f) Euclid Chemical Company (The), an RPM company; Diamond Clear VOX; Clearseal WB STD.
g) Kaufman Products, Inc.; SureCure Emulsion.
h) Lambert Corporation; Glazecote Sealer-20.
i) L&M Construction Chemicals, Inc.; Dress & Seal WB.
j) Meadows, W. R., Inc.; Vocomp-20.
k) Metalcrete Industries; Metcure 0800.
l) Nox-Crete Products Group; Cure & Seal 200E.
m) Symons by Dayton Superior; Cure & Seal 18 Percent E.
n) Vexcon Chemicals, Inc.; Starseal 0800.

H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) BASF Construction Chemicals - Building Systems; Kure-N-Seal 25 LV.
b) ChemMasters; Spray-Cure & Seal Plus.
c) Conspec by Dayton Superior; Sealcure 1315.
d) Dayton Superior Corporation; Day-Chem Cure and Seal (J-22UV).
e) Edoco by Dayton Superior; Cureseal 1315.

f) Euclid Chemical Company (The), an RPM company; Super Diamond Clear; LusterSeal 300.
g) Kaufman Products, Inc.; Sure Cure 25.
h) Lambert Corporation; UV Super Seal.
i) L&M Construction Chemicals, Inc.; Lumiseal Plus.
j) Meadows, W. R., Inc.; CS-309/30.
k) Metalcrete Industries; Seal N Kure 30.
l) Right Pointe; Right Sheen 30.
m) Vexcon Chemicals, Inc.; Certi-Vex AC 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a) BASF Construction Chemicals - Building Systems; Kure 1315.
b) ChemMasters; Polyseal WB.
c) Conspec by Dayton Superior; Sealcure 1315 WB.
d) Edoco by Dayton Superior; Cureseal 1315 WB.
e) Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f) Kaufman Products, Inc.; Sure Cure 25 Emulsion.
g) Lambert Corporation; UV Safe Seal.
h) L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
i) Meadows, W. R., Inc.; Vocomp-30.
j) Metalcrete Industries; Metcure 30.
k) Right Pointe; Right Sheen WB30.
l) Symons by Dayton Superior; Cure & Seal 31 Percent E.
m) Vexcon Chemicals, Inc.; Vexcon Starseal 1315.

2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4500 psi (31 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. The following requirements must be met for supplementary cementitious materials:

1. The minimum cumulative average for supplementary cementitious materials for all concrete provide for in this project is to be 40% recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the structural engineer. Certification and submittal of recycled content shall be in accordance with Section 018113 Sustainable Design Requirements. The following table dictates the requirements for the different types of concrete for this project. (note: FA – fly ash, GGBF – Ground Granulated Blast Furnace Slag)*

2.

Type of Concrete	Minimum Requirement	Recommended Value
Sidewalks/ Pavements**	15% FA + 20% GGBF or 20% FA or 35% GGBF	50% FA + GGBF (#)
Slabs on Grade**	15% FA + 15% GGBF or 20% FA or 35% GGBF	50% FA + GGBF (#)
Non-structural Fill	15% FA + 20% GGBF or 20% FA or 35% GGBF	50% FA + GGBF (#)
Exterior Walls	15% FA + 15% GGBF or 20% FA or 35% GGBF	50% FA + GGBF
Concrete on Metal Deck	10% FA + 20% GGBF or 20% FA or 35% GGBF	40% FA + GGBF
Interior Concrete Walls and all other concrete	15% FA + 15% GGBF or 20% FA or 35% GGBF	50% FA + GGBF
Retaining walls	15% FA + 15% GGBF or 20% FA or 35% GGBF	50% FA + GGBF (##)
Walls along gridlines A.1 and C.1A	30% (FA + GGBF) or 20% FA or 50% GGBF or 25%(FA + other)	50% (FA + GGBF) or 50% GGBF (##)

* - Other supplementary cementious material will be considered in the above requirements if proposed by the contractor. These materials will be considered in the calculation of minimum and recommended values.

** - See Specification 321313 Concrete Paving –for requirements of exterior architectural concrete paving.

- A reduction in strength of no greater than 500 psi is acceptable if recommend value for cement replacement can be increased by 10%. In no case shall the 28 day strength be less than required by the building code.

- Silica fume will be considered a cement replacement if required to meet the recommend value and does not exceed the replacement amounts in the building code

3. Recommended values for supplementary cementitious materials will be considered the total of all supplementary cementitious materials provided in the mix.
4. No minimum cement content requirements beyond what is required by the building code is required for any of the concrete specified above.
5. No minimum slump is required for any of the concrete mixes specified above. The contractor is permitted to provide any slump necessary to facilitate placement. Concrete supplier must specifically indicate what the slump is in the mix design submitted for approval and this slump must be met at the time of placement on the site.
6. Contractor to provide any and all chemical admixtures above to facilitate production of the concrete mixes.

7. Additional recommendation to minimize cement content will be considered by the commissioner. Any alterations to the minimum and recommended values must be done in writing. Additionally meetings between the concrete supplier, concrete contractor, general contractor and the commissioner will be conducted as required to maximize the efficiency of the concrete mix designs.
8. Alternate supplementary materials such as cement kiln dust, natural pozzolans, etc. will be considered as alternate supplementary cementious materials if proposed by the concrete supplier or contractor.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: As required to meet performance requirements.
3. Slump Limit: As required for proper placement

B. Foundation Walls (Non-retaining walls) and Interior Concrete Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: As required to meet performance requirements
3. Slump Limit: As required to meet placement requirements.

C. Slabs-on-Grade, Sidewalks, and Other Concrete: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4500 psi (31 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: As required to meet placement requirements.
4. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (38-mm) nominal maximum aggregate size.

5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Synthetic-macro-fiber dosage rates in subparagraph below are examples only; verify minimum dosage rates with manufacturer.
7. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 4.0 lb/cu. yd. (2.4 kg/cu. m).
8. Aggregate: Aggregate shall be from recycled sources.

D. Suspended Slabs and Concrete topping on Suspended Slabs: Proportion structural lightweight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Calculated Equilibrium Unit Weight: 105 lb/cu. ft. (1682 kg/cu. m), plus or minus 3 lb/cu. ft. (48.1 kg/cu. m) as determined by ASTM C 567.
3. Slump Limit: As required to meet placement requirements
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Steel-Fiber Reinforcement: Add to concrete mixture, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (29.7 kg/cu. m).
6. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 4.0 lb/cu. yd. (2.4 kg/cu. m).

E. Retaining Wall and Columns along Grid Line A1, Column and Walls between Grid Lines 23 and 65, Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 6000 psi (41.3 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: As required to meet placement requirements.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is between 85 and 90° F (30 and 32° C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90° F (32° C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) Class C, 1/2 inch (13 mm) Class D, 1 inch (25 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Requirements for Formliners: Contractor shall plan on having sufficient liners available during the pour. Formliners shall not compress more than 6 mm when concrete is poured at a rate of 10 ft. / hour.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50° F (10° C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Commissioner.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and re-shore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

C. Granular Course: Cover vapor retarder with granular fill fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch (0 mm) or minus 3/4 inch (19 mm).

1. Place and compact a 1/2-inch- (13-mm-) thick layer of fine-graded granular material over granular fill.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Commissioner.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

A. Flexible Water-stops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed water-stops during progress of the Work. Field fabricate joints in water-stops according to manufacturer's written instructions.

B. Self-Expanding Strip Water-stops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Commissioner.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleed-water appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40° F (4.4° C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90° F (32° C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-

half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Smooth Formlined Finish:
   1. Remove formliners. Intent is to have surface finish as-cast without rubbing. Formliners shall be removable without causing deteriorations of the surface or underlying concrete.
   2. Seam lines or match liners caused from two or more molds coming together will not be apparent when viewing final wall.
   3. Any patching or plugs of the form tie holes shall be as per the approved mockup.
   4. For Concrete Bench base, refer to Section 1.7.J for mock-up requirements.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

   1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

   1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

   1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

   a) Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
   b) Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
   c) Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
   d) Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm) 3/16 inch (4.8 mm) 1/8 inch (3.2 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Commissioner before application.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate aluminum granule finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

H. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating

with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.

3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

1. Exposed work shall be the result of a single pour without patching, unless approved by Commissioner in writing

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a) Water.
    b) Continuous water-fog spray.
    c) Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c) Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 14 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
4. Control and dispose of waste products produced by grinding and polishing operations.
5. Neutralize and clean polished floor surfaces.

C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one six month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Commissioner. Remove and replace concrete that cannot be repaired and patched to Commissioner's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Commissioner.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Commissioner's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Commissioner's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: City of New York will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

    a) When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40° F (4.4° C) and below and when 80° F (27° C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.

    a) Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b) Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

a) Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
b) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033519

POLISHED CONCRETE FLOOR FINISHING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the polished concrete floor finishing at interior slabs as shown on the drawings and specified herein.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's product data with installation instructions for color additive and penetrating sealer.

B. Submit proposed location and details of construction joints to the Commissioner for approval.

1.4 SPECIAL EXPERIENCE REQUIREMENTS (SER)

A. Installers

1. The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening have successfully completed in a timely fashion at least three (3) projects in similar scope and type to the required work.

1.5 MOCK-UP

A. Mock-Ups: Cast colored concrete mockups to demonstrate typical joints, surface finish, bonding, texture, color, tolerances, and standard of workmanship.

1. Build mock-ups approximately 100 sq. ft. in the location indicated or, if not indicated, as directed by Commissioner.

2. Notify Commissioner seven days in advance of dates and times when mock-ups will be constructed.

3. Obtain Commissioner's approval of mock-ups before starting construction.

4. If Commissioner determines that mock-ups do not meet requirements, demolish and remove them from the site and cast others until mock-ups are approved.

5. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mock-ups when directed.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement and Aggregates: Supply cement and aggregates from one domestic raw material and manufacturing source. Do not change source or type of cement or aggregate without Commissioner's written approval. Provide fine and coarse aggregate of color range and gradation to match approved samples.

1. Portland Cement: ASTM C 150, Type I or III as determined by project conditions, color: Grey.

2. Fine Aggregate: ASTM C 33, clean natural sand and shall be consistent in color and gradation in screens finer than #16.

3. Coarse Aggregate: ASTM C 33, clean crushed stone, free of material finer than #165 screen.

B. Water: Conform to ACI 301, Chapter 2, Paragraph 203.

C. Finish: Trowel texture.

D. Integral Coloring Additive: Synthetic oxide pigment meeting ASTM C 979. Color as selected by the Commissioner.

2.2 CONCRETE POLISHING MATERIALS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

B. Diamond Pads: #30, #60, #120, #220, #400, #800, #1500, as conditions dictate, or equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where polished concrete floor finishing is to be installed and notify the Commissioner of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install polished concrete floor finishing in strict compliance with manufacturer's instructions.

END OF SECTION

THIS PAGE LEFT INTENTIONALLY BLANK

SECTION 034100 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Precast structural concrete.

B. Related Requirements:

1. DDC General Conditions
2. Section 033000 – Cast-in-Place Concrete
3. Section 034500 – Architectural Pre-Cast Concrete
4. Section 051200 – Structural Steel
5. Section 071326 – Sheet Membrane Waterproofing
6. Section 071413 – Fluid Membrane Waterproofing

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at the end of Section 018113 Sustainable Design Requirements). Information to be supplied for this Form shall include:
   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

C. For all field-applied adhesives, sealants, paints, and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

D. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

E. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

F. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

G. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.

H. Shop Drawings:

I. Shop drawings shall include the following information:

1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate separate face and backup mixture locations and thicknesses.
5. Indicate type, size, and length of welded connections by AWS standard symbols.
6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
8. Include and locate openings larger than 10 inches. Where additional structural support is required, include header design.
9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
10. Indicate relationship of precast structural concrete units to adjacent materials.
11. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
12. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
13. Indicate estimated camber for precast floor slabs with concrete toppings.
14. Indicate shim sizes and grouting sequence.
15. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the

appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

16. Each shop drawing shall be dated and identified with a unique drawing number. Resubmitted shop drawings shall be given a new revision number with each resubmission, and all changes/additions/deletions from the previous submission shall be clearly and individually identified. Resubmissions received without revision numbers or identification of changes/additions/deletions will be returned unreviewed.
17. Include a transmittal letter with each submission, clearly labeled with current drawing numbers and revision numbers.
18. Shop drawings shall be clearly initialed by the draftsperson and checker responsible for their preparation.
19. Submittal of shop drawings and other submittals by the Contractor shall constitute Contractor's representation that the Contractor has verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each drawing with other drawings and other trades. The Contractor shall place their shop drawing stamp on all submittals confirming the above.
20. Shop drawings: Submit in complete packages so that individual parts and the assembled unit may be reviewed together. This Specification Section and the applicable drawings used in the development of the shop drawings shall be referenced on each shop drawing to facilitate checking.
21. Preconstruction Survey shall be performed. Before related shop drawings are prepared survey the existing construction, including beam sizes and floor construction and submit the survey prepared by a professional surveyor to the commissioner for record. The survey shall be submitted at least 60 days prior to commencement of work
22. Failure to specifically cloud modifications
23. Unapproved revisions to previous submittals
24. Unapproved departure from Contract Documents
25. Resubmittals: Completely address previous comments prior to resubmitting a drawing. Resubmit only those drawings that require resubmittal. Do not include new content not previously reviewed.

1.5 ENGINEERING SERVICES SUBMITTAL

A. For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.
   2. Design criteria for precast element are detailed in the construction documents.

1.6 DESIGN CRITERIA SUBMITTALS

A. Qualification Data: For Installer, fabricator, testing agency.

B. Welding certificates.

C. Material Certificates: For the following:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Bearing pads.
4. Insulation.
5. Structural-steel shapes and hollow structural sections.
6. Thin-brick units and accessories.
7. Stone anchors and accessories.

D. Material Test Reports: For aggregates, by a qualified testing agency.

E. Preconstruction test reports.

F. Source quality-control reports.

G. Field quality-control and special inspection reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Plant shall have the minimum certification:

a. Category C3 - Prestressed Straight Strand Structural Members.

b. Category A1 – Architectural Precast Concrete Products

B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect S2 - Complex Structural Systems.

C. Installer Qualifications: An experienced precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project installed by erector in Category S2 - Complex Structural Systems and who can produce an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products."

D. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
1. Testing agency must be registered with the New York City Department of Buildings.

E. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."

F. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.8 COORDINATION

A. The Contactor is solely responsible for any and all coordination of trades on the project.

B. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fabricators: Subject to compliance with requirements of the contract documents. Fabricators of precast to be one of the following or approved equal.
1. Oldcastle Precast
2. Global Precast
3. Artex Systems

2.2 PERFORMANCE REQUIREMENTS

A. Design Standards: Comply with ACI 318 (ACI 318M) and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

B. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets prescriptive requirements of authorities having jurisdiction or has been calculated according to ACI 216.1 (ACI 216.1M) and or PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," and is acceptable to authorities having jurisdiction.

C. Structural Performance: Provide precast structural concrete units and connections capable of withstanding design loads within limits and under conditions indicated in the contract drawings including but not limited to the following.

1. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

2.3 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

2. Mold material shall allow for a smooth finish free of obvious construction joint and bleed through from forms.

2.4 REINFORCING MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420)ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

E. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420)ASTM A 706/A 706M, deformed bars, assembled with clips.

F. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel galvanized-steel wire into flat sheets.

G. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M or ASTM A 1064/A 1064M, flat sheet.

H. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, plain, flat sheet, Type 1 bendable coating.

I. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, seven-wire or ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, seven-wire, low-relaxation strand.

B. Unbonded Post-Tensioning Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, seven-wire, low-relaxation strand.

1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

C. Post-Tensioning Bars: ASTM A 722/A 722M, uncoated high-strength steel bar.

2.6 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C 618, Class N.
3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
5. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag, Type IP, portland-pozzolan, Type I (PM), pozzolan-modified Portland, Type I (SM), slag-modified portland cement.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33/C 33M, with coarse aggregates complying with Class 5S, Class 5M, Class 4S, Class 4M. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: Uniformly graded.

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate to match approved finish sample.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
7. Plasticizing Admixture: ASTM C 1017/C 1017M, Type I.
8. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
9. Corrosion-Inhibiting Admixture: ASTM C 1582/C 1582M.

2.7 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.

D. Malleable-Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

K. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M electrodeposition according to ASTM B 633, SC 3, Types 1 and 2.

1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.

L. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79, SSPC-Paint 25 according to SSPC-PA 1.

M. Welding Electrodes: Comply with AWS standards.

N. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.8 STAINLESS-STEEL CONNECTION MATERIALS

A. Stainless-Steel Plate: ASTM A 666, Type 304, Type 316, or Type 201.

B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or A4), hex-head bolts and studs; ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or A4) stainless-steel nuts; and flat, stainless-steel washers.

1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.

C. Stainless-Steel-Headed Studs: ASTM A 276, Alloy 304 or 316, with minimum mechanical properties of PCI MNL 116.

2.9 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.
2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with

no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D 2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless- or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.10 ACCESSORIES

A. Reglets: PVC extrusions, Stainless steel, Type 302 or Type 304,felt or fiber filled, or with face opening of slots covered.

B. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.11 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.12 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
2. Limit use of fly ash to 35 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 50 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.13 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
1. Form joints are not permitted on faces of structural precast concrete with an architectural finish that is exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.14 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Commissioner's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

5. Protect strand ends and anchorages with a minimum of 1-inch- (25-mm-) thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.

K. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.

L. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.

M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

N. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Commissioner's approval.

2.15 FABRICATION TOLERANCES

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.16 COMMERCIAL FINISHES

A. Commercial Grade: Remove fins and protrusions larger than 1/8 inch (3 mm) and fill holes larger than 1/2 inch (13 mm). Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch (5 mm).

B. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

2.17 SOURCE QUALITY CONTROL

A. Testing Agency: City of New York will engage a qualified testing agency for Special Inspections per the New York City Building Code Requirements to evaluate precast structural concrete fabricator's quality-control and testing methods.

1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.

B. Testing: Test and inspect precast structural concrete according to PCI MNL 116, and NYC Building Code requirements and ASTM C 1610/C 1610M, ASTM C 1611/C 1611M, ASTM C 1621/C 1621M, and ASTM C 1712/C 1712M. The City of New York will perform special inspection of the work.

1. Test and inspect self-consolidating concrete according to PCI TR-6.

C. Strength of precast structural concrete units is considered deficient if units fail to comply with ACI 318 (ACI 318M) requirements for concrete strength.

D. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.

1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Architect.
2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
4. Report test results in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports include the following:

    a. Project identification name and number.
    b. Date when tests were performed.
    c. Name of precast concrete fabricator.
    d. Name of concrete testing agency.
    e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of Commissioner.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.

1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.

1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:

    a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
    b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
    c. Twist-off Tension Control Bolt: ASTM F 1852.
    d. Direct-Tension Control Bolt: ASTM F 1852.

3. For slip-critical connections, use method and inspection procedure approved by Commissioner and coordinated with inspection agency.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.
3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Place grout end cap or dam in voids at ends of hollow-core slabs.
5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Commissioner.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: City of New York will engage a qualified special inspector to perform special inspections as per the New York City Building Code

B. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 REPAIRS

A. Repair precast structural concrete units if permitted by Commissioner.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

D. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.6 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034100

SECTION 034500

ARCHITECTURAL PRE-CAST CONCRETE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the architectural pre-cast concrete as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Pre-cast concrete panels with exposed architectural concrete finishes.

2. Curved Precast Site Seatwalls with exposed architectural concrete finishes.

3. Provide anchorages, reinforcing bars, welded wire steel fabric, ties, supports and anchorages required for reinforcement of pre-cast concrete units.

4. Provide all structural steel inserts, lifting hooks, anchor units, plates, dowels, etc., cast in to precast concrete members required for handling and for the connections of pre-cast members, and all loose structural steel anchor units, angles, plates, etc., required to connect pre-cast units to the structural framework of the building.

5. Provide all structural steel anchor units, angles, plates, bearing pads, shims, bolting, welding, grouting, dry packing and all other materials and accessories necessary for the setting, connection and accurate placement of the pre-cast concrete units to structures. Furnish complete layout details for the installation of the above.

6. Cast in to the pre-cast units all inserts, anchors, blocking, sleeves, and housing for the attachment of electrical and plumbing equipment to the pre-cast concrete.

7. Check all lines, levels, planes and pitches required for accurate placement of work of this Section.

8. Protect, repair, patch and clean all pre-cast concrete work of this Section, as required.

9. Provide full time supervision of the erection and installation of pre-cast concrete work.

10. Furnish all mock-up work, samples, design mixes and laboratory tests required in connection with work under this Section.

11. Prepare the engineering design calculations for all architectural pre-cast concrete members and connections, and prepare required shop, erection and setting drawings and details for work under this Section.

1.3 RELATED SECTIONS

A. Cast-in-place concrete - Section 033000.

B. Structural Pre-Cast concrete - Section 034100.

C. Sealant work between pre-cast concrete units - Section 079200.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in other Subsections of concrete specifications, the manufacturer providing the material or equipment specified must, for the past five (5) years have been regularly engaged in the manufacture of material or equipment similar in type to that required for this Project. Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years. The pre-cast concrete manufacturing plant and manufacturer shall be certified by the Pre-Cast/Prestressed Concrete Institute Plant Certification Program, Certification shall be for Group A, Architectural Products.

B. Erector Qualifications: In addition to those qualifications listed in other Subsections of concrete specifications the contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

C. Fabricator has sufficient production capacity to produce required units without delaying the work.

1.5 SUBMITTALS

A. Shop Drawings: Prepare shop drawings, details and schedules as required to fully illustrate details of work and to meet job conditions. Provide separate shop drawings for mock-up work. The shop drawings shall include, but are not limited to, the following:

1. Location of each identified pre-cast concrete unit in the completed structure. Show all openings and all dimensions. Show relationship to structural framing members. Show concrete types, strengths and finishes.

2. Show reinforcing details, including grade, type and size of reinforcing bars, welded wire fabric.

3. Details of Connections: Show joints, bearings, connection devices, length and types of welds, all related embedded items and grouting and dry packing.

4. Show jointing clearances and clearances between the units.

5. Show full size typical details of joints between units, showing methods of sealant installation, coordinated with sealant contractor.

6. Prepare shop drawings in accordance with "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI-315), except where in conflict with local building regulations. Scale of details shall be adequate to fully and clearly illustrate work.

7. Submit complete design calculations for all pre-cast members and connections. Indicate all design loads, including live loads, wind loads, seismic loads, and dead loads and including all stresses during shipment and erection and due to loads from construction procedures. Design calculations shall be done by Pre-Cast Concrete Contractor's Professional Engineer, licensed to practice and registered in the State of New York. Calculations shall be submitted a minimum of four (4) weeks prior to scheduled start of fabrication. Design calculations shall be based on the design requirements specified herein.

    a. Panels and connections shall be designed for their gravity loads.
    b. Panels and connections shall be designed for lateral wind load pressures as follows:
        1). Typical Panels: As per Code.
    c. Connections of panels to structural supporting members shall be made so as to not induce eccentric or torsional forces in the supporting members.

B. Samples: Submit the following samples:

1. Cement and aggregates for architectural pre-cast concrete.

2. Submit two (2) 12" square by 1-1/2" thick samples of each type of surface required (formed or unformed) showing finishes proposed for all exposed pre-cast concrete work, using the proposed concrete mix and cast against the same form material to be actually used in the construction, finished as specified. Resubmit samples until satisfactory to Commissioner. Small size samples must be accepted by Commissioner prior to making of full size sample or starting fabrication.

    a. For each type of surface require, provide a minimum of 4 samples showing different levels of exposed aggregate finish (heavy, medium, light exposed aggregate 'sandblast' and honed finish) for Commissioner approval.

3. Prior to production fabrication of pre-cast concrete units, provide a full size sample of each shape and type of the required pre-cast concrete units at manufacturer's plant for Commissioner's review. Notify Commissioner when full size sample is ready for inspection. Do not start production fabrication of pre-cast concrete units until the full size sample has received Commissioner's written acceptance. Form materials are subject to rejection if forms used do not provide finish specified. Accepted full size sample shall be set up for display at the pre-cast plant, be adequately protected from damage, and shall serve as the standard of acceptance for similar pre-cast concrete units installed in the work, which shall be equal to and correspond in all respects to the approved full size sample. Approved

full size sample may be incorporated in the work, provided it is still in acceptable condition.

4. Commissioner's approval of small size and full size pre-cast concrete samples will be for color, texture, appearance and general condition only. Compliance with all other requirements of the Contract Documents is the exclusive responsibility of the Contractor.

5. Sample of patching methods.

C. Mock-Ups

1. Pre-cast concrete panels: Prior to the approval for fabrication of any pre-cast work, but after the approval of the full size samples, display a mock-up of the panel at the fabricator's plant.

2. Curved Precast Site Seatwalls: Prior to the approval for fabrication of any pre-cast work, but after the approval of the full size samples, display a mock-up of minimum 2 seatwall pieces installed together, showing the joint condition, on the site.

D. Submit Name of Manufacturer and/or Supplier for the following:

1. Cements, each type.

2. Aggregate, each type.

3. Reinforcing bars and pre-stressing tendons.

4. Welded steel wire fabric.

5. Concrete.

6. Welding electrodes.

7. Studs.

8. Inserts and anchors.

9. Non-shrink grout.

10. Neoprene pads.

11. Form release agent.

E. Certificates: Submit the following:

1. Mill certificates for all cement, identifying by lot material, of each grind and shipment.

2. Mill certificates for all reinforcing bars and welded steel wire fabric.

3. Mill certificates of all structural steel plates, shapes and members.

4. Notarized certificates of compliance of anchors, bolts, shear studs, welding electrodes, concrete inserts, neoprene pads, shop paint, field paint and non-shrink grout.

5. Certification of welders for welding reinforcement, shop and field connections.

6. Certification that pre-cast concrete panels, required to have fire resistive rating where so indicated on drawings, are equivalent to UL listed fire rated pre-cast concrete panels.

F. The pre-cast concrete manufacturing plant and manufacturer shall be certified by the Pre-Cast/Prestressed Concrete Institute Plant Certification Program, Certification shall be for Group A, Architectural Products.

1. Fabricator shall comply with PCI recommended methods for patching.

G. Warranty: Submit the following in writing:

1. Warrant "that the precast units will not spall or show evidence of visible warping, cracking or staining resulting from materials or workmanship by this trade for a period of one (1) year effective (insert date of substantial completion). Units showing such defects will be replaced and made good together with any work of other trades damaged during removal of defective precast units, at no expense to the City of New York."

1.6 REGULATIONS AND REFERENCE STANDARDS

A. All work shall be done according to the following codes and reference standards unless specifically shown or specified otherwise in Contract Documents:

1. Local Building Code.

2. ACI 318: "Building Code Requirements for Reinforced Concrete."

3. ACI 315: "Manual of Standard Practice for Detailed Reinforced Concrete Structures."

4. ACI 306: "Cold Weather Concreting."

5. ACI 305: "Hot Weather Concreting."

6. ACI 211.1: "Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete."

7. ACI 304-73: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."

8. ACI 347: "Recommended Practice for Concrete Formwork."

9. PCI MNL-117: "Manual for Quality Control for Plants and Production of Architectural Pre-Cast Concrete Products."

10. PCI Design Handbook, Pre-Cast and Pre-Stressed Concrete.

11. AISC Manual of Steel Construction, Latest Edition.

12. AWS D1.1 - Rev. 2: "Structural Welding Code."

13. AWS D12.1: "Reinforcing Steel Welding Code."

14. Applicable ASTM Specification.

15. Industrial Fasteners Institute, Handbook for Fastener Standards.

B. The Contractor shall have available at all times for reference the above regulations, standards, etc., editions noted (or the latest edition, if edition is not noted).

C. Where reference is made to Specifications of American Society for Testing Materials (ASTM) or other specific standards, furnish material and/or work in strict accordance with referenced standard, subject to any qualifications herein.

D. In the event of discrepancies between various regulations and standards referred to above, most stringent requirements govern.

1.7 TESTS AND INSPECTIONS

A. Proportioning and Test for Proportioning (by City of New York's Testing Laboratory): Tests for concrete mix designs shall be by Independent Testing Laboratory engaged and paid by Contractor.

B. Plant and Field Tests and Inspection (by City of New York's Independent Testing Laboratory)

1. Testing Laboratory: Plant and field tests and inspection will be conducted by Contractor's Independent Testing Laboratory and/or field inspector engaged and paid by the City of New York.

2. Plant Tests and Inspections by City of New York's Independent Testing Laboratory shall be in accordance with PCI, MNL-117, Sections 2.1.1 and 2.1.3.

3. Field Tests and Inspection by City of New York's Independent Testing Laboratory shall include, but not be limited to:

a. Erection methods.
b. Connections in accordance with approved shop drawings.
c. Welding of connections.
d. Compliance with erection tolerances.
e. Compliance of all members with sizes, types and finishes.
f. Checking leveling and grouting.
g. Inspection of bearing pads.
h. Field tests for concrete strength, if required.
i. Checking and cleaning of joint edges prior to erection of units and width of joints between erected units.

C. Form TR3: Technical Report Concrete Design Mix: The Contractor shall be responsible for, and bear all costs associated with, the filing and securing of approvals,

if any, for Form TR3: Technical Report Concrete Design Mix, including, but not limited to , engaging the services of a New York City licensed Concrete Testing Lab for the review and approval of concrete design mix, testing, signatures and professional seals, etc., compliant with NYC Department of Buildings requirements, for each concrete design mix.

1.8 REJECTIONS

A. Defective Work: Precast concrete units which do not conform to the specified requirements, including dimensional tolerances, strength, and finishes, shall be replaced with pre-cast concrete units that meet the requirements of this Section. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the pre-cast concrete work.

1. Defective pre-cast concrete units and materials may be rejected at any time, whether in place or not. Promptly remove and replace rejected pre-cast concrete units and materials at no additional cost to the City of New York.

B. Dimensional Tolerances: Units having any dimension smaller or greater than required, and outside the specified tolerance limits, will be considered deficient and shall be rejected if the appearance or function of the unit is adversely affected, or if the larger dimensions interfere with other construction. Repair, or remove and replace, rejected units as required to meet the construction conditions.

C. Strength Deficiencies: When there is evidence that the strength of a pre-cast concrete unit does not meet specification requirements, the City of New York's Testing Laboratory, upon direction from the Commissioner, and with the City of New York's written approval, shall take cores drilled from hardened concrete or perform non-destructive strength tests to determine compressive strength.

1. Determination of compressive strength by drilled cores shall comply with ASTM C42 and as follows:

a. Take at least three (3) representative cores from pre-cast units of suspect strength, from locations directed by the Commissioner.
b. Test cores in a saturated surface dry condition per ACI 318 if the concrete will be wet during the use of the completed structure.
c. Test cores in an air dry condition per ACI 318 if the concrete will be dry at all times during use of the completed structure.
d. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least eighty-five (85) percent of the twenty-eight (28) day design compressive strength.
e. Test results will be made in writing on the same day that tests are made, with copies to the Commissioner and Contractor. Include in test reports the project identification name and number, date, name of pre-cast concrete manufacturer, name of concrete testing service, identification letter, number, and type of member or members represented by core tests, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length diameter ratio), direction of applied load to core with respect to horizontal plane of concrete as placed, and moistened condition of core at time of testing.

2. Patching: Where core test results are satisfactory and pre-cast units are acceptable for use in the work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

D. Finishes: Architectural pre-cast concrete units whose finish has any of the following defects will be rejected. Repair the following finish defects if permitted by the Commissioner, or remove and replace rejected units as required to meet the requirements of this Section.

1. Does not match previously approved samples as to uniformity of color or texture.

2. Has chipped, ragged, irregular or broken corners or edges.

3. Joints, false joints, drips or notches are not properly located or aligned.

4. Has damaged surfaces, notches or other surface defects.

5. Excessive air pits and voids evident on the exposed surfaces.

6. Adjacent flat and return surfaces with more than a slight difference in exposure.

7. Casting lines evident from different placements.

8. Visible form joints or irregular surfaces.

9. Rust staining on panel surfaces.

10. Blotching or acid stains evident on panel surfaces.

11. Foreign material embedded in the facing mix.

12. Cracks visible after wetting.

13. Visible repairs.

14. Reinforcement shadow lines.

1.9 DESIGN CRITERIA

A. Engineering of pre-cast members shall be done by a Professional Engineer, licensed and registered in the State of New York, with experience in pre-cast concrete design.

1. Structural Criteria

a. Engineer architectural pre-cast concrete units to:
   1). Panels and connections shall be designed for their gravity loads.
   2). Panels and connections shall be designed for lateral wind load pressures as follows:
      (a). Typical Panels: As per Code.
   3). Connections of panels to structural supporting members shall be made so as to not induce eccentric or torsional forces in the supporting members.

4). Allow for expansion and/or contraction, without harmful affect to the units, connections, joint seals, or adjoining construction due to a temperature range of 0 degrees F to 120 degrees referenced to 70 degrees F.

2. Connections: Provide all connections for the effect of shrinkage forces, temperature changes, and deflection of the supporting or adjacent structures. Connections shown on the Contract Drawings do not relieve the manufacturer of the responsibility for the design and performance of connections.

3. Reinforcing: Conform to requirements of ACI 318-77. Reinforce all bearing areas against diagonal tension, splitting, rupture and flexure. Place extra ties, stirrups and reinforcing bars at support points. Allow no bearing pressure in edges of unreinforced section.

4. Corners: Exterior corners of pre-cast panels shall return at the corner of each unit as indicated on the drawings. No mitered joints at exterior corner shall be allowed.

5. Lifting Devices: All inserts to be used for lifting or handling shall be on non-exposed surfaces.

1.10 DELIVERY, STORAGE, HANDLING AND PROTECTION

A. Storage of Materials

1. General: Store unpackaged materials on clean platforms and protect from deterioration and intrusion of foreign matter with suitable covers. Immediately remove damaged material.

2. Cement: Store in weathering structure with floor not less than one (1) foot above ground to protect against dampness and contamination. Provide easy access for proper inspection and identification of material.

3. Aggregates: Store fine and coarse aggregates separately to avoid segregation, intrusion of dirt, or foreign materials. Stockpile aggregates at least twenty-four (24) hours before being used.

4. Reinforcing Steel and Accessories: Take care to protect against soiling, corrosion and deformation. Store in manner to facilitate selection and minimize handling.

B. Deliver pre-cast concrete units to the project site in such quantities and at such time as will assure the continuity of the installation.

C. Store units so as to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and handle units at the designated lift and handling points only.

D. Handle, transport, store and erect units in such a manner that they will not be overstressed or damaged. Transport pre-cast concrete units on vehicles of sufficient length with points of support as needed.

E. Recess lifting hooks and, after removal, paint the cut ends with liquid galvanizing and fill the recess with grout.

F. Stack units on properly cushioned non-staining supports to protect the edges.

G. Protect against water and ice in freezing weather, particularly holes, reglets, false joints, and other recesses.

H. Protect the work of other trades during erection and final cleaning.

I. Protect work while in progress and after installation. Use non-staining coverings.

1. Protect exposed corners where there is likelihood of damage with substantial coverings.

2. Protect exposed concrete finished surfaces from damage caused by construction equipment materials or methods, and from running water.

3. Protect all exposed concrete surfaces from damage or spillage by any trade during course of erection. Such concrete surfaces shall be free of damage at the time of acceptance. This protection shall assure prevention of damage to surfaces from paints, oils, plaster, mortar or other stains or abrasions.

4. Maintain protection until work of this Contract is complete. Remove protection when directed by the Commissioner.

PART 2 PRODUCTS

2.1 FORMWORK

A. Provide forms that are non-reactive with concrete and will produce the required finish surfaces.

B. Accurately construct forms mortar-tight and of sufficient strength to withstand all pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide complete pre-cast concrete units of shapes, lines, and dimensions indicated, within the specified fabrication tolerances.

C. Unless forms for plant manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not included in pre-cast units due to deformation of concrete under pre-stress or to movement during detensioning.

D. Refer to Article 2.6 herein for further information.

2.2 REINFORCEMENT MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60.

B. Welded Wire Steel Fabric: ASTM A185, cold drawn wire. Supply in flattened sheets or mats. Tie wires for pre-cast work: #16 monel metal.

C. Steel Wire: ASTM A82, plain, cold drawn, steel.

D. Reinforcing Bar Accessories: Type to suit the condition; non-corrosive.

E. For concrete surfaces exposed to view, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III.

1. Pre-cast concrete panels

a. Use only one brand and type of cement throughout the project, unless otherwise acceptable to the Commissioner.
b. Use white Portland cement for facing concrete mix to match Commissioner's control sample.
c. Standard "gray" Portland cement may be used for non-exposed backup concrete.

2. Curved Precast Site Seatwalls

a. Use only one brand and type of cement throughout the project, unless otherwise acceptable to the Commissioner.
b. Use white Portland cement for concrete mix to match Commissioner's control sample.

B. Coarse Aggregate for Facing Mixes: ASTM C 33; stone aggregate that is hard, durable, carefully selected and graded; free of material causing staining or reacting with cement.

1. Precast Concrete Panels: Use aggregate from same source as those used in Commissioner's control sample.

2. Curved Precast Site Seatwalls: Coarse aggregate shall be to match that in specification 321313 for Concrete Paving.

C. Fine Aggregate for Facing Mixes: ASTM C 33.

D. Water: Drinkable, free from foreign materials in amounts harmful to concrete and embedded steel.

E. Air-Entraining Admixture: ASTM C 260.

F. Non-Metallic, Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621, equal to one of the following:

1. Euco N.S.; Euclid Chemical Co.

2. Masterflow 713; Master Builders

3. Five Star Grout; U.S. Grout Corp.

4. Or equal approved by the Commissioner.

G. Color Admixture:

1. Admixture must be certified to be compatible with the cement, aggregates, and all other constituent materials.

2. Color Admixture shall be manufactured from one production run, shall have integral dispersal agents, and shall be packaged in dissolvable bags for the treatment of one yard. Color shall be as selected by the Commissioner.

3. For the Curved Precast Site Seatwalls: Admixture shall be to match that in specification 321313 for Concrete Paving.

H. Exposed Retarder: Exposed Retarder for Curved Precast Site Seatwalls shall be as specified in Specification 321313 Concrete Paving, or as recommended by precaster in order to achieve control sample approved per paragraph 1.5 B 2a herein. Type and amount of material, to treat the surface with the specified exposure, shall be as recommended by the manufacturer.

I. Concrete Finish Types for Architectural Pre-Cast Concrete

1. PV-02 Pigmented Precast Concrete Plank Paving

Color Admixture: Pigmented Concrete shall be integrally colored using pigment admixture, color as follows:

Color: L. M. Scofield RL 8171 Oyster White solar reflective index 68.
Cement: White Cement.
Finish: Heavily Exposed Aggregate Finish, 3/8" Mt. Airy Granite.
Joint Sealant: Color to Match Pigmented Concrete.

Pigment Source (Or Approved Equal)

a. L. M. Scofield
   Contact: Rich Liptak
   Tel: 204-672-9051
b. Davis Colors
c. Solomon Colors Inc.

2. PV-04 Precast White Concrete Tee Box Slabs, Columns, Plinths

a. Use white Portland cement for facing concrete mix to match Commissioner's control sample. Minimum Solar Reflectance Index (SRI) of 29 shall be achieved.

2.4 MISCELLANEOUS MATERIALS

A. Steel Hardware Units

1. Steel Plates: Structural quality, hot rolled carbon steel complying with ASTM A 36, or ASTM A 283, Grade C.

2. Structural Size Steel Shapes: ASTM A 36.

3. Bar Size Steel Shapes, Steel Bar Flats, and Steel Bar Rounds: ASTM A 36 or ASTM A 306, Grade 65.

4. Threaded Rods: Shall be coil rods made of high tensile grade steel. The rated ultimate capacity for 3/4" rods to be thirty-six thousand (36,000) lbs., for 1" rods seventy-five thousand (75,000) lbs. Dayton Sure-Grip and Shore Co., or equal.

5. Anchor Bolts: ASTM A 307, low carbon steel bolts, regular hexagon nuts and carbon steel washers.

6. Finish of Steel Hardware Units and Fasteners: Hot dip galvanized steel complying with ASTM A 123 or A 153 as applicable.

7. Epoxy coated dowels: furnish epoxy coated steel bars conforming to ASTM a615, grade 60. Fabricate dowels or cut to length at the shop or mill prior to delivery to the site. Ensure that dowels are free of loose flaky rust and scale, clean and straight. Before delivery, paint a minimum of two thirds the length of each dowel with one coat of epoxy paint. . Shear dowels to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel.

B. Weldments: To conform with the requirements of the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Building."

C. Shear Connectors: As manufactured by Nelson Stud Welding, KSM Products, or equal approved by the Commissioner.

D. Shims: Plastic, "Korolath," (or equal) 80,000 psi.

E. Flashing Reglet: Twenty-eight (28) gauge (0.014") stainless steel, Type 302/304; type profile and conditions as shown on drawings.

F. Touch-Up Galvanizing Compound: "ZRC Cold Galvanizing Compound" made by the ZRC Chemical Co. (or equal)

2.5 QUALITY AND PROPORTIONING (MIX DESIGN)

A. Concrete Compressive Strength: Five thousand (5,000) psi minimum, at twenty-eight (28) days.

B. Concrete Weight: All pre-cast concrete shall be normal weight concrete having an air-dry weight of one hundred fifty (150) lbs. maximum per cubic feet of concrete.

C. Concrete Slumps: The Contractor must satisfy himself that he is capable of producing concrete of satisfactory quality and strength, that will produce the specified finishes, free of voids, honeycombing, or excessive air bubbles. Execution of this contract

signifies that the Contractor accepts full responsibility for the production of concrete of satisfactory quality, strength and finishes.

D. Air-Entrained Concrete: All architectural pre-cast concrete shall be air entrained, using the specified air-entraining admixture as per manufacturer's written instructions, to provide entrained air, by volume, in the cured concrete of between three (3) percent and six (6) percent.

E. Proportioning and Tests for Proportioning

1. Responsibility: The Contractor shall be responsible for making and paying for all concrete design mixes and tests to determine the suitability of ingredients and the proportion of specified ingredients for the concrete type and strength, of the specified air entrainment, that will be fully workable for all placing conditions and that will produce finishes acceptable to the Commissioner.

2. Ingredients Tests: Prior to making design mixes, the Contractor's Testing Laboratory shall conduct the following tests in accordance with the procedures referred to in the Reference Standards to assure conformance with the Project Specifications.

   a. Cement: Specific gravity of cement.
   b. Aggregates: Sieve analysis, specific gravity, soundness, percentage of voids, absorption, and moisture content of fine and coarse aggregate. Dry rodded weight of coarse aggregate. Fineness modulus of fine aggregate.

3. Concrete Design Mixes

   a. Design Mixes: The Contractor's Independent Testing Laboratory shall recommend the design mixes to be used for the project for the type and strength of concrete that will produce concrete of specified strengths and finishes. Design mixes shall indicate water-cement ratio, water content, admixture content, cement content, aggregate content, aggregate gradations, slump, air content and strength. Design mixes and related tests shall be in accordance with the procedures referred to in the Reference Standards.
   b. Trial Mixes: For the type and strength of normal weight concrete, made four (4) trial mixes, using varying water-cement ratios.
   c. Strength of Trial Mixes: Per ACI Standards.

4. Additional Tests: Contractor, at no expense to the City of New York, shall have the Contractor's Testing Laboratory conduct additional tests on concrete ingredients and make new design mixes whenever the character or source of ingredients is changed or if the placed concrete fails to meet specified strengths.

2.6 FABRICATION

A. Reference Standards: Fabricate pre-cast concrete units so as to comply with the manufacturing and testing procedures and quality control recommendations of Pre-Cast Concrete Institute's MNL-116 and MNL-117 "Manuals for Quality Control for Production of Pre-Cast Pre-Stressed Concrete Products and of Architectural Pre-Cast Products," except as modified herein.

B. Concrete: Store, measure, mix and deliver concrete in accordance with PCI MNL-117, ASTM C 94, and as herein specified.

C. Formwork

1. Reference Standards: Formwork shall conform to ACI 347-68 "Recommended Practice for Concrete Formwork," and to requirements specified herein.

2. Molds: Cast pre-cast concrete units in one-piece seamless rigid molds for exposed faces, except where two-piece molds are permitted. Molds shall be made of smooth fiberglass, or other suitable material acceptable to the Commissioner, conforming to shape, profile, lines and dimensions indicated, so as to obtain a smooth finish matching Commissioner's samples and approved pre-cast concrete unit full size samples. Prevent deformation of molds and maintain surfaces of molds free of irregularities, dents, sags, or damage of any kind. The forms or molds must be designed to withstand vibration and lateral forces, and must be accurate in details, with sharp corners and arrises so as to assure finished units satisfactory to the Commissioner and matching approved samples. There shall be no visible joints or seam lines in the molds or in the finished concrete surface, unless joint or lines are required by Commissioner's drawings.

3. Holes and Embedded Items: Contractor shall provide all holes and openings (both cast-in and drilled) required for his work and for work of other trades. All holes and openings shall be cast in. Contractor shall furnish and install all embedded items required for work of other trades furnished by other subcontractors. Accurately locate and position embedded items and secure to formwork. See drawings, including drawings of other subcontractors, for extent and location of holes, openings, drips and embedded items. Show all holes, openings, drips and embedded items on shop drawings. Coordinate with other subcontractors.

4. Built-In Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect the position of main reinforcement or the placing of concrete.

5. Form Release Coating: Before each casting, coat surfaces of thoroughly cleaned forms with a bond breaking compound before reinforcement is placed. Provide commercial formulation form coating compounds that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments or sealing (with sealant) of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

a. Where sealant bond is affected by form release coating, coating must be thoroughly removed by abrading surface (i.e. grinding, sandblasting, etc.) to insure no loss of adhesion of sealant.

D. Exposed Unformed Surfaces: All panels exposed to exterior on two (2) sides shall be floated and/or troweled on the unformed surface in a manner which will enable finishing to match the formed surface. Floating and/or troweling shall be consistently performed on all unformed surfaces. All unformed surfaces shall be oriented as indicated on the drawings.

E. Reinforcement

1. Reference Standards: Reinforcement shall conform to ACI 318 "Building Code Requirements for Reinforced Concrete" and to ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" and to requirements specified below.

2. Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.

3. Reinforcement Cover: Place reinforcement to obtain the minimum coverage for concrete protection, which shall be 1-1/2" from face exposed to weather and one (1) inch from face not exposed to weather unless otherwise indicated on drawings.

4. Positioning and Securing Reinforcement: Accurately position support and secure reinforcement against displacement by formwork, construction, or concrete placement operations.

5. Welding: Perform all welding in accordance with AWS D1.1 - Rev. 2 and AWS D12.1. All welders shall be properly certified by AWS. Care shall be exercised during welding to minimize effect of welding heat. Welds shall be designed to prevent a tearing at end of weld which could cause a progressive failure. Detailed welding procedure covering all specified welds on erection and shop drawings may be requested for review and comment by the Commissioner.

F. Place concrete in a continuous operation to prevent the formation of seams or planes of weakness in pre-cast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete in each pre-cast unit by internal and external vibration without dislocation or damage to reinforcement and built in items. Internal vibration, if necessary, shall not touch reinforcement.

G. Identification: Provide permanent markings in pre-cast units to identify pick-up points and orientation in the structure, complying with the markings indicated on the final shop drawings. Imprint the date of casting on each pre-cast unit where it will not show in the finished structure.

H. Curing: Cure in accordance with applicable reference standards.

I. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

J. Fabricate units straight, smooth, and true to size and shape, with exposed edges and corners precise and square unless otherwise indicated.

1. Pre-cast units that are warped, cracked, broken, spalled, stained, or otherwise defective will not be acceptable.

K. Finish of Formed Surfaces

1. For Architectural Pre-Cast Concrete Units: All exposed formed surfaces and exposed troweled surfaces of architectural pre-cast concrete units shall have smooth "as-cast" finish. Where exposed aggregate finish is noted, conform to:

    a. Light acid etched finish, producing a "matte" surface to match approved samples.
    b. It is the intent of these specifications that no patching of architectural pre-cast concrete will be required. In the event remedial action is required, it shall consist of patching with approved patching mortar and then texturing. No patching shall be done without the Commissioner's written approval.

2. For Curved Precast Site Seatwalls with exposed architectural concrete finishes: All exposed formed surfaces and exposed troweled surfaces of architectural pre-cast concrete units shall have smooth "as-cast" finish. Where exposed aggregate finish is noted, conform to:

    a. Exposed aggregate sample approved by Commissioner, provided according to paragraph 1.5 B 2a herein.

    b. It is the intent of these specifications that no patching of architectural pre-cast concrete will be required. In the event remedial action is required, it shall consist of patching with approved patching mortar and then texturing. No patching shall be done without the Commissioner's written approval.

L. Finish of Unformed Unexposed Surfaces: All unformed surfaces of pre-cast concrete shall be consolidated, brought to a proper level with a straight edge, floated and then given the following finish:

    1. Uniform Float Finish: Typically for all surfaces not exposed to view.

M. Quality Control: Pre-cast unit manufacturer shall institute quality control procedures for the manufacture, inspection and testing of pre-cast units in compliance with recommendations of PCI MNL-117. Furnish the Commissioner and City of New York's Testing Laboratory with copies of test reports and/or certifications for materials and quality control testing of pre-cast units.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where architectural pre-cast concrete elements are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected by the responsible trade to permit proper installation of the work.

3.2 INSTALLATION

A. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

B. Do not install pre-cast units until concrete has attained its design strength.

C. In handling and lifting, use only lifting inserts provided.

D. Place no pre-cast concrete units or material in the work that is damaged.

E. Install pre-cast concrete units plumb, level, square and true, without exceeding the recommended erection and location tolerances of PCI, MNL-117, unless more stringent requirements are specified herein. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected.

F. Anchor units in final position by bolting, welding, grouting, or as otherwise shown on drawings. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed. Make adjustments as required to maintain accurate face joint dimensions.

1. At bolted connections use lock washer, "Slotlok" system welding or other approved means to prevent loosening of nuts.

2. At welded connections apply galvanizing touch-up compound specified herein.

G. Welding: Perform all welding in compliance with AWS D1.0 and D12.1, including qualifications of welders.

H. Protect units from damage by field welding or cutting operations during erection and provide non-combustible shields as required.

3.3 ERECTION TOLERANCES

A. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.4 CLEANING

A. After erection of architectural pre-cast concrete units and after completion of joint treatments and when other work has been substantially completed, clean exposed architectural pre-cast concrete work to remove all dirt, dust, blemishes, stains or other discolorations. Clean exposed architectural pre-cast concrete work by brushing vigorously with non-staining detergent and clean water. Drench and rinse architectural pre-cast concrete units with clean water. Cleaning, washing, rinsing and other methods necessary to clean architectural pre-cast concrete shall be in accordance with architectural pre-cast concrete manufacturer's recommendations, as approved by the Commissioner. Do not use cleaning materials or processes which could change the character or appearance of the exposed architectural pre-cast concrete finishes.

B. Protect other work from damage due to cleaning operations.

END OF SECTION

SECTION 034900

GLASS FIBER REINFORCED CONCRETE (GFRC) PANELS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the glass fiber reinforced concrete (GFRC) panels as indicated on drawings and specified herein.

1.3 RELATED SECTIONS

A. Joint Sealers - Section 079200.

1.4 REFERENCES

A. ASTM C 33 – Specification for Concrete Aggregates

B. ASTM C 150 – Specification for Portland Cement

C. PCI MNL 128 – Recommended Practice for Glass Fiber Reinforced Concrete Panels

D. PCI MNL 130 – Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products

1.5 QUALITY ASSURANCE

A. Manufacturers:

1. The manufacturer providing the material or equipment specified in this section must, for the past five (5) years have been regularly engaged in the manufacturer of material or equipment similar in type to that required for this Project, Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years.

B. Installers

1. The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening have successfully completed in a timely fashion at least three (3) projects in similar scope and type to the required work.

C. Mock-Ups: Provide mock- ups as indicated on Contract Drawings, including but not limited to; GF-01 GFRC roof eave corner, two panels.

1. Prepare a mock-up at the Site, including all components shown on approved Working Drawings, indicating the final relationship and configurations of the various parts and components and the quality of workmanship that shall be achieved in the work.

    a. Build mock-up full height and width of opening, at location as indicated on Contract Drawings, and part of an area to receive the work of this Section.
    b. Build mock-up of adequate length to include all items that are part of the wood veneer panel system including anchorages and sealant system.
    c. Incorporate materials and methods of fabrication and installation that are identical with Project requirements. Accepted mock-up may be incorporated into the finished work provided the mock-up matches the finish of all other panels installed and is not discolored or damaged as a result of natural elements and effect of weather.
    d. Build as many mock-ups as required to obtain Commissioner's acceptance. Disassemble rejected mock-ups and remove all components from Site. Do not incorporate rejected mock-up components into the work.
    e. Wood veneer panel installation that proceeds without an approved mock-up shall be stopped, and a mock-up prepared for Engineer's approval.

D. Visual Inspection of Fabrication and Installation of Materials and Systems: Prior to installing Work of this Section, construct each form of construction and finish required to demonstrate aesthetic effects and qualities of materials and execution.

1. Provide installation for visual inspection in location as indicated on the Drawings for approval by Commissioner for compliance with project design and quality requirements prior to commencement of additional work on specified system or component. The Engineer reserves the right to request rectification of work deemed unsatisfactory.

2. Notify the Engineer 7 working days in advance of dates and times when installation will be constructed.

3. Make necessary adjustments in installation, as determined by Engineer's review, and secure Engineer's acceptance.

4. Maintain accepted installation of systems and components during construction in undisturbed condition as standard for judging completed Work.

5. Accepted sample installations in undisturbed condition at time of Substantial Completion may become part of completed Work.

6. Installation shall include the following elements:

    a. CW-01 (curtain wall).
    b. GF-01 (GFRC eave).
    c. PR-01 (plaster on exterior grade GWB).
    d. WD-01 (wood veneer panel 1).
    e. WD-06 (wood mullion).

f. Provide installation for 'visual inspection' for all components concurrently, in location as shown on Architectural Contract Drawings.

1.6 QUALITY CONTROL

A. Submit a sample of fabricator's quality assurance procedures before beginning fabrication. A test sample from each day's mix shall be retained by manufacturer for a period of one (1) year after fabrication. GFRC units shall match the color and finish specified and samples provided.

B. Testing: Samples shall be analyzed daily for material mix weight, spray rate, and fiberglass content using the washout method. Panel thickness shall be tested with pin gauges during production at a spacing of not more than 24 inches, to verify skin thickness at 5/8 inch or heavier. Mechanical strength tests and anchor pull-off tests, if required, shall be approved as to type, frequency, and cost by agreement with the Engineer.

C. Dimensional Control: Inspect each unit in shop to insure that it conforms with the dimensions and tolerances shown on the drawings. Fabrication dimensions shall be held to permit installation within the following tolerances:

1. Face Width of Joints: 1/8 inch.

2. Out of Plane (unit to unit): +/- 1/16 inch.

3. Variation in Plumb: 1/4 inch in 10 feet.

4. Variation in Level: 1/4 inch in 10 feet.

D. Cleaning: Remove all surface contamination prior to shipment, to provide a clean, uniform appearance.

E. Efflorescence: All panels shall be free of efflorescence both prior to and following installation.

1.7 GLASS FIBER REINFORCED CONCRETE PERFORMANCE CRITERIA

A. The components and assemblies of the GFRC panel system shall comply with the Codes and regulations of all Governing Agencies having jurisdiction. When applicable Codes or specified requirements differ, the more stringent conditions shall be provided. Except when applicable codes make other provisions, or as otherwise noted herein, the loads shall act in combinations that provide the most unfavorable conditions.

B. GFRC component system shall be designed for axial, flexural, shear and torsional stresses and any combination thereof due to wind, thermal, moisture and gravity loads.

C. Wind Loads: The wind loads on the GFRC components and its connections shall be positive and negative per local Building Code.

D. Design Wind Pressure shall be multiplied by a Load Factor of 1.50. With this Load Factor applied, design stresses shall not exceed yield point level or elastic buckling level, whichever is lower. No wall element, including sealants and sealed joints, shall

sustain permanent deformation or failure under loading equivalent to 1.5 times the Design Wind Pressures.

E. Stresses shall not exceed the allowable values established and recommended by Prestressed Concrete Institute. In no case shall allowable values exceed the yield stress. For load combinations, a reduction in load or increase in allowable stress (but not both) may be used only if permitted by code.

F. Building Dynamics: Building dynamics are defined as any building movements or deflections caused by the effect of wind, thermal, seismic, live, impact and/or concentrated loads, including the kinetic deflections resulting from the dead load of materials. The GFRC assemblies shall accommodate the inherent building dynamics, including the tolerances of related work.

G. Anchorage and Structural Support Framing: Anchors and supports indicated and/or noted on the drawings are schematic and do not necessarily indicate the exact and/or required scope, type, shape or profile. Additional anchorage and structural support framing shall be added or complemented as required.

H. Points of support for the assemblies shall be properly braced in the three orthogonal directions (vertical, transverse and longitudinal) to resist loads. from any direction, including, but not necessarily limited to, the positive and negative wind pressures and seismic loads.

I. Anchorage and support framing shall be designed to accommodate thermal and building movements without any harmful effect to the assemblies specified, including sealant applications. The anchors (bracing, inserts, clips, bolts, etc.) shall be designed at 6.0 times the design load in addition to all other forces to insure the yield point or elastic buckling level, whichever is lower.

1.8 SUBMITTALS

A. The Contractor shall prepare and submit for approval catalog cuts, drawings, and reference materials in accordance with the General Conditions, - Contractor's Working Drawings, Design and Shop Drawings.

1. Working Drawings: Placing drawings shall be submitted, including checked Working Drawings for manufacture and erection of GFRC panels and shall indicate:

a. Drawings and Calculations stamped and sealed by a Professional Engineer licensed in the state of New York.
b. Unit shapes, including elevations and sections, member piece marks and dimensions.
c. Plans and elevations locating and defining all products furnished by the manufacturer.
d. Finishes.
e. Relationship to adjacent materials.
f. Reinforcement, joint and connection details.
g. Erection sequence and handling requirements.
h. Lifting and erection inserts.
i. All dead, live and applicable loads used in the design.

j. Location, dimensional tolerances, and details of anchorage devices that are embedded in or attached to structure or other construction.
k. Other items cast into panels.
l. Handling procedures, plans and/or elevations showing panel location and sequence of erection for special conditions.

B. Samples: Submit samples representative of finished exposed face showing typical range of color and texture. Submit samples and obtain approval prior to commencement of manufacture.

1. Sample size: 12 inches by 12 inches by thickness indicated on the Contract Drawings, representative of the proposed finished product, including support framing.

C. Calculations for GFRC panels prepared and sealed by a Professional Engineer licensed in the State of New York and recognized as an expert in the specialty involved.

1. Engineering Calculations: Submit engineering and design calculations to substantiate the anchoring methods and fastening devices and all GFRC elements indicated on the submitted shop drawings.

2. Calculations shall establish compliance with specified stress at all principal elements and the structural analysis of all connections. If calculations indicate any deficiencies, provide all items necessary to comply with the performance requirements without cost to the City of New York.

3. Provide details and calculations to verify and supplement the general design.

D. Fabricator's quality assurance procedures.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product

listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.9 LEED PERFORMANCE REQUIREMENTS

A. GFRC panels shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with the DDC General Conditions.

B. GFRC panel materials fabricated within, and containing raw materials extracted within, 500 miles of the project site shall be documented in accordance with the DDC General Conditions.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of the DDC General Conditions where applicable.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling: Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses or damage.

1. Lift or support units only at the points shown on the erection shop drawings.

2. Place non-staining resilient spacers of even thickness between units.

3. Support units during shipment on non-staining shock-absorbing material.

4. Protect units from dirt and damage during handling and transport.

B. Storage at Job Site: Store units to protect them from contact with soiling, staining, and from physical damage.

1. Store units, unless otherwise specified, with non-staining, resilient supports located in same positions as when transported.

2. Store units on firm, level, and smooth surface.

3. Place stored units so that identification marks are easily readable.

PART 2 PRODUCTS

2.1 CASTINGS

A. Castings: Castings shall be produced in accordance with the standards set by the Prestressed Concrete Institute (PCI) as published in the manual "Recommended Practice for GFRC Panels," and shall conform to the color and surface appearance of the samples provided. All anchorage attachments shall be supplied by the GFRC fabricator. Castings produced by the alternate pre-mix method using approved AR-Glass fibers shall also be deemed acceptable.

1. Castings may be produced by the premix process, as outlined in PCI Standard Practices Manual or GFRC (Appendix J). The pre-mix material typically has flexural 28-day strength and yield of 700 to 1200 (psi), but Arc's panel design is based on a 900 (psi) yield strength for added safety factor.

B. Forms: Metal, plastic, wood, or other material that is non-reactive with concrete and will produce smooth surface finishes shall be used for form construction. Forms shall be constructed of sufficient strength to withstand pressures of molding operations without deformation. Form work shall be maintained during production to provide completed GFRC units of shapes, lines, and dimensions indicated, within specified fabrication tolerances.

2.2 MATERIALS

A. Portland Cement: ASTM C 150 Type I

B. Aggregate: ASTM C 33 manufactured sand unless otherwise specified.

C. Fiberglass Reinforcement: Alkali-resistant (AR) fiberglass filaments shall be continuously introduced by a premix process into the GFRC mix for all backing coats in a manner to produce a continuously dispersed fiberglass mat reinforcement. Insertion of fiberglass mats or scrims shall not be acceptable.

D. Water: All water used in mixing shall be potable quality, free from harmful minerals or foreign materials in amounts harmful to concrete.

E. Polymer: Polymer compounds shall be added in accordance with the Polymer manufacturer's specifications to increase the strength and durability of the GFRC units.

F. Polymer compounds shall be proven by independent laboratory test analyses to eliminate the need for wet curing of the GFRC castings.

G. Mold Release Agents: Mold release compounds shall not interfere with the adhesion of sealants or finishes specified under normal preparation requirements.

H. Curing: All cast GFRC components shall be cured in a controlled environment after release from the mold for a minimum of five days before finishing.

I. Patching Material: Patching of materials is unacceptable. Panels will be rejected if installed with areas damaged in shipment or handling.

J. Steel Stud Framing System: Provide prefabricated welded frame produced in accordance with approved erection drawings, with accessible welds touched up after welding.

1. Material

a. Painted Studs and Tracks: Formed from steel conforming to ASTM A 570 or ASTM A 611 (Grades A, B, C or D).
b. Galvanized Studs and Tracks: Formed from steel conforming to ASTM A 446.
c. Structural Tubing: Formed from steel conforming to ASTM A 500.
d. Steel Channels and Angles: Formed from steel conforming to ASTM A 36.

2. Finish

a. Rust inhibitive paint shall conform to FS-TT-P636C.
b. Galvanized coating shall conform to ASTM A 525 with a minimum G-60 coating.

3. Yield Strength:

a. Studs: 40 ksi minimum.
b. Tracks: 30 ksi minimum.

2.3 GFRC PANELS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following or equal approved by the Commissioner:

1. Formglas Inc.

2. Casting Designs, Inc.

3. Plasterform, Inc.

B. GF-01: Glass fiber reinforced concrete (GFRC) panel.

1. Basis of Design Product: FormGlas GFRC-l "S.Sand-SB."

2. Provide specified product or an approved equal acceptable to the Commissioner.

2.4 FABRICATION

A. Dimensional and Performance Characteristics: Fabrication of GFRC shall be done to achieve the following characteristics when aged 28 days:

1. Shell Thickness: 5/8 inch +1/8 inch – 0 inch (Panels).

2. Shell Thickness: 1 inch +1/2 inch – 0 inch (Terra Cotta Replacement Stones).

3. Glass Fiber: 5 - 6% by weight (Roving - Alkali-Resistant fiber).

4. Glass Fiber: 3 - 4% by weight (Premix - Alkali-Resistant fiber).

5. Compressive Strength: 6,000 psi (cube sample).

6. Flexural Yield Strength: 900 – 1,500 psi (roving method).

7. Flexural Yield Strength: 700 - 1,200 psi (test average - pre-mix method).

8. Flexural Ult. Strength: 2,000 – 3,500 psi (roving method).

9. Flexural Ult. Strength: 1,400 - 1,800 psi (test average - pre-mix method).

10. Weight: 6 – 7 lbs/sq. ft.

B. Surface: Units shall be fabricated to provide a smooth surface, free of pockets, sand streaks, honeycomb, finished by blast cleaning and/or acid washing to achieve the specified surface finish.

C. Piece Identification: Each unit shall be marked with an identifying mark corresponding with shop and/or erection drawings and date cast.

D. Support Frames and Embedded Support Anchors:

1. Support frames shall be designed by the manufacturer and fabricated of track and stud or steel tubing sections, of sufficient strength and rigidity to support the GFRC units and prevent overstressing of the skin during de-molding and handling, with flexible connections to permit relative movement of the GFRC and the attachment frame.

2. Galvanized steel support track and stud frames shall be of minimum 16 gauge, steel tubing minimum 11 gauge, steel attachment plates minimum 16 gauge, and embedded anchors 3/8 inch diameter or larger as required

3. Material specifications shall conform to those listed in PCI MNL-117. Carbon steel tubular frames shall be shop painted one coat of zinc oxide primer and one coat of alkyd enamel.

4. As an alternate to galvanized construction, steel tubing members may be painted with inorganic zinc-rich one-step primer with a minimum zinc content of 80% dry film, with a finish coat of compatible enamel.

5. Flexible anchors shall be made of carbon steel bar stock, with corrosion protection by cadmium or zinc electro-plating.

6. Where through-bolt attachments are used for suspended pieces, stainless steel washers shall be embedded in the GFRC mix, and a countersunk area shall be provided for the attachment nut, including wrench clearance. Avoid exposed attachements through panels in all locations. Any exposed fasteners shall be recessed and designed to be field patched smooth. Provide test data showing that the proposed attachment has a minimum safety factor of ten. Welded joints shall be protected by a rust-inhibitive coating.

E. Anchorage: Provide anchors and fasteners for attachment to the structural steel work unless otherwise specified.

F. Control Joints: Design units with adequate control joints for sealing with backer rod and caulk joints in the field.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for environmental conditions, installation tolerances, and other conditions affecting performance of glass fiber reinforced concrete panels.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide building lines, center and grades in sufficient detail to allow installation of the GFRC units, true, level bearing surfaces, and shall provide for the accurate placement and alignment of anchor bolts, plates or dowels on the structure.

B. Prior to installation of units, check the job site dimensions affecting the work. any discrepancies between design dimensions and field dimensions which could adversely affect installation in accordance with the contract documents shall be brought to the attention of the Commissioner. Installation shall not proceed until discrepancies are corrected or until installation requirements are modified and reviewed by the Commissioner.

C. Examine GFRC components prior to installation.

1. Prior to installation, any piece with flaws, imperfections, dimensional errors, improper tolerances, damage, discolorations, staining, or otherwise not considered suitable and/or acceptable to the Commissioner, will be subject to rejection.

2. Defective items shall be removed from the job site and replaced to the Commissioner's satisfaction. Repairs, such as gluing of broken units are not to be allowed.

D. Touch up galvanized steel surfaces which are scratched or damaged, with zinc-rich paint and/or approved "Galvanize Repair" paint products. Clean metal thoroughly before touch up.

E. Provide clear, well-drained unloading areas and maintain road access around the building to a degree that the hauling and erection equipment for the GFRC units are able to operate under their own power.

3.3 INSTALLATION

A. Setting: Set GFRC units in accordance with drawings and final shop drawings. Provide anchors, supports, fasteners and other attachments shown or necessary to secure work firmly in place. Shim and adjust accessories for proper setting of units.

1. Make necessary provisions for the employment of the suitable lifting devices at points provided by the manufacturer.

2. Erect GFRC units plumb and true with joints uniform in width and accurately aligned within the allowable tolerances.

3. Provide temporary supports and bracings as required to maintain position, stability and alignment as units are being permanently connected.

   a. Provide slotted holes in connection and attachments to accommodate induced panel movement due to creep, thermal, moisture, field tolerances and dimensional changes in the structural frame.

4. Fasten GFRC units in place by bolting or welding or both as shown on approved erection drawings. Field welding shall be done by qualified welders using equipment and materials compatible to the base material. Protect GFRC surfaces during field welding. Field paint welds to provide corrosion protection with inorganic zinc-rich primer and enamel.

B. Tolerances for location of GFRC units shall be non-cumulative. For erection tolerances, see PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

C. Contiguous Work: Provide openings and other provisions as shown or required for contiguous work. Close up openings in units after other work is in place. Use materials and set to match surrounding units.

D. Seal GFRC units in accordance with Section 079200, "Joint Sealers."

3.4 INSPECTION AND ACCEPTANCE

A. Final inspection and acceptance of erected GFRC panels shall be made by the Commissioner to verify conformance with plans and specifications.

B. Acceptability of Appearance: The finished construction in place shall present a uniform, appearance when viewed by the Commissioner with the naked eye under typical lighting conditions at a distance of 10 feet and shall show no imperfections at a distance of 20 feet.

C. Minor spiderweb cracking in the face coat shall be acceptable, providing it does not adversely affect the appearance as noted above.

3.5 ADJUSTING AND CLEANING

A. Patching: Avoid field patching in all cases. If required, field patching shall be performed using materials provided by the GFRC manufacturer to match color and texture of surrounding materials and shall be approved by Commissioner.

B. Cleaning: Clean GFRC panels in accordance with cleaning methods approved by fabricator. After installation, clean soiled or effloresced area of GFRC surfaces with detergent and water, using fiber brush and sponge, and rinse thoroughly with clean water. Use extreme care to prevent damage to GFRC surfaces and to adjacent materials. Soiled surface must be thoroughly rinsed with clean water immediately after using cleaner.

3.6 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and installer that ensures that GFRC panels are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 035300

CONCRETE TOPPING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the concrete topping as shown on the drawings and/or specified herein, including but not limited to the following:

1. Concrete topping applied over concrete floor slabs and compatible with radiant heating systems.

2. Concrete polished finishes.

1.3 RELATED SECTIONS

A. Cast-in-Place Concrete - Section 033000.

1.4 QUALITY ASSURANCE

A. Codes and Standards: ACI 301 "Specifications for Structural Concrete"; ACI 318, "Building Code Requirements for Reinforced Concrete"; and ACI 302; comply with applicable provisions.

B. Comply with ACI 302.

C. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.

1.5 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's product data with installation instructions for materials including reinforcement, admixtures, joint materials, curing materials and others as requested by Commissioner.

B. Laboratory Reports: Submit 2 copies of laboratory test or evaluation reports for concrete materials and mix designs. Do not mix until approved by the Commissioner and Waterproofing manufacturer.

1. Mix Proportions and Design: Proportion mixes complying with mix design procedures specified in ACI 301 211.2.

C. Shop drawings showing extent of work and control/construction joints.

D. Pre-Installation Conference: Conduct conference at project site.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II

B. 3/8" crushed limestone aggregate: ASTM C 33.

C. Natural Sand Fine Aggregate: ASTM C 33.

D. Wet curing and sealing compound as recommended by manufacturer.

E. Topping Mix: Design mix to produce topping material with following characteristics:

1. Compressive strength, 4500 psi minimum.

2. Slump, 4" maximum.

3. Cement per cu. yd., 630 lb. minimum.

4. W/C ratio, 0.45 maximum.

5. Maximum shrinkage (without shrinkage reducing admixture): 0.045 percent

6. Shrinkage-Reducing Admixture: "Eclipse" by W.R. Grace or approved equal at a rate as recommended by manufacturer.

7. Aggregate: Limestone only; aggregate size as large as is practical.

8. Minimum weight: 110 pcf; no to exceed 145 pcf.

F. Mixing: Provide batch type mechanical mixer for mixing topping material at project site. Equip batch mixer with a suitable charging hopper, water storage tank, and a water-measuring device. Use mixers that are capable of mixing aggregates, cement and water into a uniform mix within specified time, and of discharging mix without segregation.

1. Mix each batch of 2 cu. yds. or less, for at least 1-1/2 minutes after ingredients are in mixer. Increase mixing time 15 seconds for each additional cu. yd. or fraction thereof.

G. Joints: Provide saw cut control and construction joints as approved. Use standard pre-molded joint filler at perimeters finished with backer-rod and sealant.

H. Reinforcement: Provide ASTM A 185 4 x 4 - W4 x W4 welded wire fabric within topping slab.

I. Stainless Steel Divider Strips: Use 1/4 thick plate anchored to angles with slotted connections fastened to structural slab. Set flush with top of finished floor.

2.2 POLISHED CONCRETE FINISH

A. General: Decorative ground concrete is produced by grinding and finishing trowel finished cured concrete in a manner similar to that for terrazzo.

B. Do not consolidate concrete with the use of vibrating or tamping. Allow concrete to cure minimum 28 days.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where concrete topping is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Commissioner.

3.2 INSTALLATION

A. Topping Applied to Concrete: Remove dirt, loose material, oil, grease, paint or other contaminants, leaving a clean surface.

1. Install slip sheet/waterproofing membrane in all locations, in accordance with manufacturer's instructions.

B. Placing and Compacting: Spread topping mixture evenly over prepared base, bring to required level with straight-edge and strike-off. After placement, do not work surface further until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power driven floats. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.

C. Reinforcement: Install welded wire fabric at mid height of the topping slab. Use metal or plastic chairs to accurately locate welded wire fabric. Cut every other wire that pass under a control joint.

D. Concrete Finishes

1. Screed to true and level alignment unless indicated sloped on drawings.

2. Do not absorb water with neat cement.

3. Float finish.

E. Polished Concrete Finish:

1. Rough grinding: Grid with 26 grit diamond plugs to remove surface fines and expose aggregate. Maintain specified concrete flatness.

2. Following initial grind with tow additional grinds using 80 grit diamonds and 80 grit stones (max depth of grind = 1/8")

3. Cleanse floor with clean water and rinse. Remove excess rinse water to prevent staining.

4. Steel trowel Portland cement grout onto surface to fill all voids, cement grout to match color of concrete, allow to cure overnight.

5. Fine Grinding: Grind with 80 grit or finer stones to remove grout and 120 grit diamonds until polished terrazzo-like surface is achieved. Concrete shall show a minimum of 60 percent aggregate.

6. Wash all surfaces with neutral cleaner with Ph factor between 7 and 10, biodegradable and phosphate free.

F. Check and level surface plane to tolerance not exceeding F_1 40. Immediately after leveling, refloat surface to a uniform, smooth finish. Contraction joints to be soft cut on the same day as pour with high speed masonry saw 3/4" deep. Intermediate joints to be 1/4" deep. Joint pattern as shown on drawings.

1. Wet cure topping for a minimum of 7 days or achieving 80% of specified compressive strength after refloating surface. Perform in accordance with ACI 308.

END OF SECTION

SECTION 042000

UNIT MASONRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the unit masonry work as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Concrete block interior partitions.

2. Metal joint reinforcing, anchors, and related accessories for masonry.

3. Control joints in masonry, filled with joint fillers.

4. Chases, recesses, pockets and openings in masonry as required for installation of work by others.

5. Building in of items furnished by others into masonry, including access doors, door frames, anchors, sleeves and inserts, and other similar items to be embedded in masonry.

6. Grouting in of metal items built into masonry work.

7. Protection, pointing and cleaning of masonry.

1.3 RELATED SECTIONS

A. Firestops and Smokeseals - Section 078413.

B. Joint Sealers - Section 079200.

1.4 SUBMITTALS

A. Shop Drawings: Submit for:

1. Anchoring details.

2. Control and expansion joint locations and details.

B. Samples (Submit the following):

1. Joint reinforcing, each type, width and proposed location (labeled).

2. Anchors, each type, width and proposed location (labeled).

3. Joint filler, each type.

4. Mortar color, 12" long cured sample.

C. Manufacturer's Literature: Submit technical and installation information for:

1. Mortar materials, each material and mortar type.

2. Certification of mortar mix.

3. Concrete block, joint reinforcing, anchors, ties and joint filler; submit manufacturer's technical and descriptive literature.

4. Block manufacturer shall submit certifications of compliance with ASTM C 90, C 331 and UL 618 prior to any job site delivery. Field sample of concrete block may be tested by an Independent Testing Laboratory retained by the City of New York according to the requirements of ASTM C 140.

D. Construction Procedures: Submit proposed procedures and materials for cleaning masonry work; including certification that cleaner will not adversely affect gaskets, sealants, etc.

1.5 QUALITY ASSURANCE

A. Work of this Section shall conform to the requirements of the following:

1. 2011 ACI 530/ASCE 5/TMS 402 Building Code Requirements for Masonry Structures.

2. 2011 ACI 530-1/ASCE 6/TMS 602 Specifications for Masonry Structures.

1.6 PRODUCT HANDLING

A. General: Deliver, store, handle and protect all materials from damage, moisture, dirt and intrusion of foreign matter. Store all masonry units and mortar materials on raised platforms and under ventilated and waterproof cover. Store packaged materials in manufacturer's unopened containers, marked with manufacturer's name and product brand name. Immediately reseal containers after partial use. Remove and replace damaged materials.

B. Masonry Units: Pack, deliver and store to prevent breakage, cracking, chipping, spalling or other damage. Store, protect and ventilate units at project site.

C. Aggregate: Store with provisions for good drainage.

D. Reinforcement and Anchors: Store and protect so that when placed, joint reinforcement and anchors will be free of soil, dirt, ice, loose rust, scale, or other coatings which would destroy or reduce bond with mortar, and will not be disfigured or bent out of shape.

1.7 CODE REQUIREMENTS

A. Work of this Section shall conform to all applicable requirements of the New York City Building Code.

1. Concrete block shall comply with Chapter 21 of 2008 New York City Building Code.

2. Concrete blocks shall be type approved by the Board of Standards and Appeals.

a. Concrete blocks used for fireproofing shall conform to New York City Building Code requirements and shall provide ratings required by the Contract Documents.

B. Fire rated masonry partitions shall have MEA or BSA number.

C. Conform to New York City Local Law 17-95 for seismic requirements.

1.8 JOB CONDITIONS

A. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Immediately remove grout, mortar, and soil that come in contact with such masonry.

PART 2 PRODUCTS

2.1 MATERIALS

A. Standard Concrete Block

1. Portland cement, ASTM C 150, Type 1, low alkali (less than 0.6%), single source for entire project.

2. Aggregates, ASTM C 331, lightweight expanded shale, clay or slate aggregates, manufactured by the rotary kiln process equal to "Solite," "Norlite," or "Haydite."

3. Concrete Masonry Units: Load bearing lightweight aggregate concrete masonry units conforming to the requirements of ASTM C 90, Type 1.

a. Block for fire-rated walls shall be 75% solid units.

4. The producer of the concrete masonry units shall furnish certification from an independent testing laboratory confirming that all 8" or larger masonry units meet all of the UL 618 requirements for two (2) hours or better (as required), referencing full scale fire test reports (ASTM E 119). All 4" and 6" units shall conform to "National Bureau of Standards" and "National Research Council" full scale fire tests.

5. Sizes and Shapes: Nominal face size 8" x 16" by thickness as indicated on drawings, with stretcher units, jamb units, header units, square corner units (at ends and corners of exposed or painted work), sash units (at control joints within

masonry wall), lintel units and other special shapes and sizes required to complete the work.

6. Finish: For exposed block surfaces, in addition to ASTM requirements, block shall have uniformly dense, flat, fine grain texture, with no cracks, chips, spalls, or other defects which would impair appearance. For concealed CMU, surfaces shall be free from deleterious materials that would stain plaster or corrode metal.

7. Curing: All concrete block shall be steam cured, and air dried for not less than thirty (30) days before delivery.

8. Density of concrete block shall not exceed one hundred and five (105) lbs. per cubic foot.

9. Shrinkage: Shrinkage of concrete blocks shall not exceed 0.065% when tested in accordance with ASTM C 426-99.

10. Water Content

    a. At the time of delivery to the job site, concrete masonry units shall have a value, in weight of contained water, of not more than thirty (30) percent of the fully saturated content for the unit tested.
    b. Ship all units from the factory, and store at the job site, with all necessary protection to prevent increase of water content from rain and other sources.

B. Joint Reinforcing for Masonry Walls: For interior block walls and partitions, provide standard reinforcing fabricated of 9 ga. side and cross rods, truss or ladder design, no ties, spaced every other block course. Provide prefabricated pieces at corners and intersections of walls or partitions. Reinforcing shall be mill galvanized conforming to ASTM A 641, Class B-1, applied after fabrication.

1. Wire used in assemblies noted above shall be cold drawn steel wire conforming to ASTM A 82.

2. Approved Joint Reinforcing Manufacturers

    a. Hohmann & Barnard
    b. Dur-O-Wal
    c. Heckmann Building Products
    d. National Wire Products Industries, Inc.

C. Anchors

1. Wire Mesh: Galvanized sixteen (16) gauge steel wire, 1/4" square mesh, width 1/2" less than wall thickness, by length to suit condition.

2. For anchoring masonry to structural steel, provide hot-dip galvanized steel, as listed, or approved equal by manufacturer noted above:

    a. Made by Heckmann Building Products. Galvanizing shall conform to ASTM A 153, with zinc coating of 1.5 oz. of zinc per sq. ft.
        1). No. 195 Column Anchors

2). No. 197 Column Anchors
3). No. 315 Weld-On Anchor Rods with No. 316 Triangle Ties
4). No. 315-B Weld-On Anchor Straps with No. 316 Triangle Ties

b. Made by Hohmann & Barnard or approved equal. Galvanizing shall conform to ASTM A 153, with zinc coating of 1.5 oz. of zinc per sq. ft.
1). No. 355 Column Anchors
2). No. 356 Column Anchors
3). No. 357 Beam Anchors
4). No. 359 F anchor straps with VWT tie.

3. For anchoring CMU interior partitions to underside of steel beams, provide hot dip galvanized steel tube anchors equal to No. 419 and No. 421 made by Heckmann Building Products, No. PTA-420 made by Hohmann & Barnard, or approved equal by manufacturer noted above.

4. For anchoring CMU interior partitions to underside of structural deck, provide 4" x 4" x 1/4" galvanized steel angles (ASTM A 36), 3'-0" long spaced 3'-0" o.c. alternately on each side of partition. Anchor partition securely to structural deck.

D. Reinforcing Bars and Rods: ASTM A 615, Grade 60. See Drawings for size.

E. Control Joint Fillers

1. Vertical Installation Within Concrete Masonry Wall: Extruded high grade neoprene rubber, cross shape, for use with concrete masonry sash units, which shall provide a force fit in the grooves of the sash block, and shall have 1/2" diameter tubular ends (compressed 25% when installed in 3/8" wide joint).

a. Provide the following sizes:
1). 2-5/8" wide control joint fillers for 4" block walls.
2). 4-5/8" wide for 6" block walls.
3). 6-5/8" wide for 8" block walls.

b. Provide backer rod and sealant joint over joint filler as per drawings and Section 079200 of these specifications.

2. Isolation Joint Filler at Abutting Construction and at Intersecting CMU Walls: Compressible and resilient closed cell neoprene gasket with pressure sensitive adhesive backing, thickness 30% greater than thickness of joint. Acceptable joint filler shall be "Everlastic, Type NN-1" by Williams Products, Inc., or approved equal. Recess joint filler and install backer rod and sealant as per drawings and Section 079200 of these specifications.

F. Neoprene Joint Filler: Provide closed cell neoprene, Type NN-1, conforming to ASTM D 1056, Grade 1, high performance, as manufactured by Williams Products Inc., or equal made by D. S. Brown, Norton, or approved equal.

G. Concrete Sealer: Clear sealer equal to "Perma-Crete" interior acrylic masonry surface sealer.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type 1, standard color, one source.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: Clean, washed, buff colored sand, graded per ASTM C 144.

D. Water: Clean, fresh and suitable for drinking.

2.3 MORTAR MIX

A. Interior Masonry Construction: Provide Portland cement/lime mortar conforming to ASTM C 270, Type N; for load bearing conditions, mortar shall conform to ASTM C 270, Type M.

B. Reinforced Concrete Block: Provide Portland cement/lime mortar conforming to ASTM C 270, Type S.

C. Grout for Unit Masonry: Comply with ASTM C 476 for grout for use in construction of unit masonry. Use grout of consistency (fine or coarse) at time of placement which will completely fill all spaces intended to receive grout. Grout shall have a minimum compressive strength of 3000 psi when tested in accordance with ASTM C 1019.

D. Mixing

1. General: Add cement just before mixing and mix dry. Use sufficient amount of water as necessary to produce workable mix. Mix in small batches to make plastic mass.

2. Mixing: Machine mix all mortars in approved type mixer with device to accurately and uniformly control water. Add hydrated lime dry. Mix dry materials not less than two (2) minutes. Add water, then mix not less than three (3) minutes, not to exceed five (5) minutes. Mix only amount of mortar that can be used before initial set. Do not use mortar which has reached its initial set or two (2) hours after initial mixing, whichever comes earlier. Mortar may not be re-tempered. Clean mixer for each batch, whenever mortar type is changed, and at end of each day's work.

3. Acceleration or other admixtures not permitted.

4. Mortar shall have a flow after suction of not less than seventy-five (75) percent of that immediately after mixing as determined by ASTM C 91.

E. Admixtures

1. No air-entraining admixtures or cementitious materials containing air-entraining admixtures shall be used in the mortar.

2. No antifreeze compounds or other substances shall be used in the mortar to lower the freezing point.

3. Calcium chloride or admixtures containing calcium chloride shall not be used in mortar.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that masonry may be completed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.

B. Discrepancies: In the event of discrepancy, immediately notify the Commissioner in writing. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved. Starting of work by the Contractor means acceptance by the Contractor of the substrate.

3.2 COORDINATION

A. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work of this Section.

3.3 INSTALLATION

A. General

1. Do not wet concrete block units.

2. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown.

3. Build chases and recesses as shown or required for the work of other trades.

4. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

5. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and off-sets. Avoid the use of less than half size units at corners, jambs and wherever possible.

6. Lay up walls plumb and true with courses level, accurately spaced and coordinated with other work.

7. Pattern Bond: Lay exposed masonry patterns as noted on drawings. If not shown, provide running bond. Lay concealed concrete block with all units in a wythe bonded by lapping not less than two (2) inches. Bond and interlock each course of each wythe at corners. Do not use units of less than four (4) inches horizontal face dimensions at corners or jambs.

8. Where possible, masonry walls and partitions shall be built after all overhead ducts, pipes and conduits are in place and tested. Masonry shall be neatly built around the items above. Walls and partitions shall be plumb, true to line and free from defects such as open cells, voids, dry joints and other similar defects. In rooms and spaces scheduled to have concrete block finish, all such surfaces, including upper wall surfaces up to termination of structural ceiling in spaces without suspended ceilings, shall be made suitable for paint application. Cutting of openings in walls and partitions in place shall be done only with the approval of the Commissioner.

B. Mortar Bedding and Jointing

1. Lay concrete masonry units with full mortar coverage on horizontal and vertical face shells.

2. Lay masonry walls with 3/8" joints unless otherwise shown on drawings.

3. Tool exposed joints slightly concave. Concealed joints shall be struck flush.

4. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Built-In Work

1. As the work progresses, build in items specified under this and other Sections of these specifications. Fill in solidly with masonry around built-in items.

2. Mortar in door frames, access doors, louvers and other metal items embedded or built into masonry work solidly with mortar as the masonry units are laid up.

3. Grout under lintels, bearing plates, and steel bearing on masonry with solid bed grout.

4. Sleeves, pipes, ducts and all other items which pass through masonry walls shall be caulked with interior grade sealant meeting requirements of Section 079200, so as to be air tight and prevent air leakage. Refer to Section 078413 for packing of voids in rated masonry walls.

5. Fill vertical cells of masonry units solid with grout which have anchoring, reinforcing rods, supporting or hanging devices embedded in the cell, including stone anchors and window or curtain wall anchors.

6. Fill vertical cells of masonry units solid with mortar on each side of door frames to sixteen (16) inches beyond.

7. Unless otherwise noted, fill vertical cells of masonry units solid with grout which are below steel bearing plates, steel beams, and ends of lintels, to eight (8) inches beyond bearing and from floor to bearing.

8. Place wire mesh in horizontal joint below masonry unit cells to be filled with mortar, to prevent mortar from dropping into unfilled cells below.

9. Masonry indicated as being reinforced shall have all voids filled solid with grout. Grout shall be consolidated in place by vibration or other methods which insure complete filling of cells. When the least clear dimension of the grouted cell is less than two (2) inches, the maximum height of grout pour shall not exceed twelve (12) inches. When the least clear dimension is two (2) inches or more, maximum height of grout pour shall not exceed forty-eight (48) inches. When grouting is stopped for one (1) hour or longer, the grout pour shall be stopped 1-1/2" below the top of a masonry unit. Vertical bar reinforcing shall be accurately placed and held in position while being grouted, and shall be in place before grouting starts. All such reinforcing shall have a minimum clear cover of 5/8". Lap all bars a minimum of forty (40) bar diameters and provide steel spacer ties (not to exceed 192 bar diameter) to secure and position all vertical steel and prevent displacement during grouting. Provide continuous horizontal reinforcement embedded in mortar joints every second course.

D. Cutting and Patching

1. All exposed masonry which requires cutting or fitting shall be cut accurately to size with motorized carborundum or diamond saw, producing cut edges.

2. Holes made in exposed masonry units for attachment of handrail brackets and similar items shall be neatly drilled to proper size.

3. All masonry which requires patching in exposed work, if approved by Commissioner, shall be patched neatly with mortar to match appearance of masonry as closely as possible and to the Commissioner's satisfaction. Rake back joints and use pointing mortar to match as required.

E. Solid Wall Construction

1. Fill the vertical longitudinal joint between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging.

2. Tie wythes with continuous horizontal reinforcement embedded in mortar joints sixteen (16) inches o.c. vertically.

F. Interior Block Partitions

1. Build to full height unless otherwise shown on drawings. At non-rated partitions, fill void between CMU and structural deck with continuous neoprene filler conforming to the requirements of Article 2.4 herein. At fire rated partitions, fill void with fire stop material meeting the requirements of Section 078413. Fasten to structure at top of partition using steel angles as specified herein.

2. Provide continuous horizontal joint reinforcing every other block course, except as otherwise noted. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8". Lap reinforcement a minimum of six (6) inches at ends of units.

3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

4. Corners

   a. Provide interlocking masonry unit bond in each course at corners.
   b. Provide continuity at corners with prefabricated "L" reinforcement units, in addition to masonry bonding.

5. Intersecting and Abutting Walls

   a. Unless vertical control joints are shown as part of structural frame, provide interlocking masonry bond. Provide starters and special shapes as shown on the drawings to bond these walls.
   b. In addition to masonry bonding, provide horizontal reinforcement using prefabricated "T" units at interior partitions.

G. Anchoring Masonry to Structure: Provide an open space not less than 1/2" in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

H. Control Joints

1. Provide vertical control and isolation joints in masonry as shown. Build in related items as the masonry work progresses.

2. CMU Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 20'-0" o.c. In addition, locate joints at points of natural weakness in the masonry work, including the following:

   a. At structural column or joint between bay.
   b. Above control joints in the supporting structure.
   c. Above major openings at end of lintels upward and below at ends of sills downward. Place at one side of jamb for openings not less than 7'-0" wide and at both sides for openings over 6'-0" wide.
   d. At reduction of wall thickness.
   e. Where masonry abuts supporting structure.
   f. If additional joints are required, indicate same on approved shop drawings.

I. Lintels: For concrete block walls, use specially formed U-shaped concrete block lintel units with reinforcing bars in accordance with the following table, filled with grout.

Number and Size of Reinforcing Bars Required at Concrete Block Lintels		
Maximum Clearance Span	Wall Width	Rebar No. - Size
2'-0" to 6'-0" 6'-0" to 8'-0"	6"	2 - #3 2 - #4
2'-0" to 6'-0" 6'-0" to 8'-0"	8"	2 - #3 2 - #4
2'-0" to 6'-0" 6'-0" to 8'-0"	12"	3 - #3 3- #4

3.4 CLEANING, PROTECTION, ADJUSTMENT

A. Protection: The Contractor shall take adequate precautions for the protection of all surfaces against mortar spatter, and shall immediately remove any such spatter should it inadvertently occur, leaving no stain or discoloration.

1. Excess mortar shall be wiped off the masonry surfaces as the work progresses.

2. Wood coverings shall be placed over all such masonry surfaces as are likely to be damaged during the progress of the entire project.

3. Protective measures shall be performed in a manner satisfactory to the Commissioner.

4. Damaged masonry units shall be replaced to satisfaction of the Commissioner.

B. Cleaning of Masonry: Upon completion, all exposed masonry shall be thoroughly cleaned following recommendations of the BIA Technical Note No. 20. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 4' x 4' in a location approved by the Commissioner. No further cleaning work may proceed until the sample area has been approved by the Commissioner, after which time the same cleaning materials and method shall be used on the remaining wall area. If stiff brushes and water do not suffice, the surface shall be thoroughly saturated with clear water and then scrubbed with a solution of an approved detergent masonry cleaner, equal to "Vana Trol" made by ProSoCo Inc. or equal made by Diedrich or approved equal, mixed as per manufacturer's directions, followed immediately by a thorough rinsing with clear water. All lintels and other corrodible parts shall be thoroughly protected during cleaning.

1. Unless otherwise required by cleaning agent manufacturer use only low pressure device (30 to 50 psi) for application of cleaning agent and water rinsing.

C. Pointing: Point any defective joint with mortar identical with that specified for that joint.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 044010

GABION SITE WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 RELATED SECTIONS

A. Sustainability Requirements - Section 013010
B. Earthwork - Section 312000

1.3 REFERENCES

A. ASTM A313-13, Specification for Chromium Nickel Stainless and Heat-Resisting Steel Spring Wire
B. ASTM A370-12a, Test Methods and Definitions for Mechanical Testing of Steel Products
C. ASTM A641-09a, Specification for Zinc Coated (Galvanized) Carbon Steel Wire
D. ASTM A975-11, Standard Specification for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel Wire with Polyvinyl Chloride (PVC) Coating)
E. ASTM B117-11, Standard Practice for Operating Salt Spray (Fog) Apparatus
F. ASTM D746, Standard Test Method from Brittleness Temperature of Plastics and Elastomers by Impact
G. ASTM D792-13, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacment
H. ASTM D412-06a(2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension

1.4 SUBMITTALS

A. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

4. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

B. Product Data: Cut sheets from manufacturer showing all products and product data

C. Calculations: Contract Drawings show intent only. Contractor shall engage a Professional Engineer licensed in the State of New York to perform detailed design of the Gabion Site Walls based on the layout shown on the Contract Drawings and the approved gabion basket system. Final calculations shall be signed and sealed by the engineer responsible or their production.

1. Design shall be based on walls founded on dense, saprolitic soils or till with a minimum bearing pressure of 10 ksf and 35 psf/ft equivalent hydrostatic pressure for backfill.

2. Seismic design shall be based on a force equal to 0.045_h^2.

D. Shop Drawings: Provide detailed shop drawings that include, at a minimum, the following information:

1. Wall height and front face batter

2. Sections through walls of each type and height

3. Layout of baskets

4. Proposed filling sequence

5. If different filler stones are to be used beside the specified face stone, provide cross sections showing proposed fill pattern.

6. Proposed baskets including size of mesh, wire gauge, coatings and size of each basket unit.

7. Connection and closure details.

E. Samples: Submit samples for the following:

1. Submit 24 inches x 24 inches sample of basket fabric to be supplied for approval by the Engineer.

2. Proposed infill stone and/or drain rock in 10 lb bag for approval by the Commissioner.

1.5 QUALITY ASSURANCE

A. Qualifications

1. The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening have successfully completed in a timely fashion at least three (3) projects in similar scope and type to the required work.

B. Mock-up: Visual Inspection of Fabrication and Installation of Materials and Systems. Prior to installing Work of this Section, construct each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Provide installation for visual inspection along first 36' length of gabion wall starting from the east end of gabion wall #16, starting at the east at Cell #6 and moving west to Cell #3. See landscape drawings for location. Provide installation for approval by Commissioner for compliance with project design and quality requirements prior to commencement of additional work on specified system or component. The Commissioner requires rectification of work, if deemed unsatisfactory.

2. Notify the Commissioner 7 days in advance of dates and times when installation will be constructed.

3. Make necessary adjustments in installation, as determined by Commissioner's review, and secure Commissioner's acceptance.

4. Maintain accepted installation of systems and components during construction in undisturbed condition as standard for judging completed Work.

5. Accepted sample installations in undisturbed condition at time of Substantial Completion may become part of completed Work.

1.6 LEED PERFORMANCE REQUIREMENTS

A. The project's environmental performance goals include achieving minimum LEED-NC v2.2 Silver certification for the work done within LEED boundary including,

1. Specific project goals that may impact this area of work include:

a. Use of materials with recycled-content
b. Use of locally extracted and manufactured materials
c. Construction waste management

B. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated LEED PERFORMANCE REQUIREMENTS section.

C. Gabion site walls shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with the LEED Certification Requirements Section (Products used outside of the LEED boundary are exempted from the certification requirements).

D. Gabion Site Walls materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance the LEED Certification Requirements Section (Products used outside of the LEED boundary are exempted from the certification requirements).

E. Preference should be given to alternatives to PVC wire coating.

PART 2 PRODUCTS

2.1 WOVEN MESH GABIONS

A. Gabion Basket – Provide 9 feet x 3 feet x 3 feet woven mesh basket made from a double twisted hexangonal steel wire mesh which is reinforced with heavier wire selvgedges along the edges and by transverse diaphragms, with PA6 (Polyamide 6) coating in the color grey.

1. The gabion basket should match in material and appearance with the existing adjacent built gabion walls.

2. The baskets should contain a minimum of 90% post consumer recycled content.

B. Comply with ASTM A975-11.

C. Wire shall comply with the following; all tests on the wire mesh must be performed prior to manufacturing the mesh.

1. Tensile strength: Both the wire used for the manufacture of gabions and the lacing wire, shall have a tensile strength of 54,000 to 70,000 psi, in accordance with ASTM A641-09a.

2. Elongation: Test must be carried out on a sample at least 12 inches long. Elongation shall not be less than 12%, in accordance with ASTM A370-12a

3. Zinc coating: minimum quantities of zinc according to ASTM A641-09a, class III soft temper coating

4. Adhesion of the zinc coating to the wire shall be such that, when the wire is wrapped six turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers, in accordance with ASTM A641-09a.

D. Steel Mesh Properties

1. Mesh Tensile Strength: shall have a minimum strength of 2900 lb/ft when tested in accordance with ASTM A975 Section 13.1.1.

2. Punch Test Resistance: shall have a minimum resistance of 5300 lb when tested in accordance with ASTM A975 section 13.1.4.

3. Connection to selvedges: shall have a minimum resistance of 1200 lb/ft when tested in accordance with ASTM A975.

E. PA6 (Polyamide 6) Coating

1. Specific Gravity: 68 pcf in accordance with ASTM D792, Table 1

2. Hardness: 82 M, according Hardness Rockwell

3. Tensile Strength: Not less than 8,690 psi, according to ASTM D412-06a(2013).

4. Accelerated Aging Tests

   a. Salt Spray Test: Test period 3,000 hours, test method ASTM B117-11.
   b. Exposure to UV Rays: After 4000h UV exposition mechanical and physical characteristics of base polymer must be superior than 75% of the start performances [ISO 4892-2]
   c. Brittleness Temperature: No higher than -22°F, or lower temperature when specified by the purchaser, when tested in accordance with ASTM D746

5. Properties After Accelerated Aging Tests

   a. Appearance of coated mesh: No cracking, stripping or air bubbles, and no appreciable variation in color.
   b. Specific Gravity: Variations shall not exceed 6%. c. Hardness: Variations shall not exceed 10%.
   c. Tensile Strength: Variations shall not exceed 25%.
   d. Modulus of Elasticity: Variations shall not exceed 25%. f. Abrasion Resistance: Variations shall not exceed 10%.

e. Brittleness Temperature: Shall not exceed + 140°F (+60°C)

F. PA6 (Polyamide 6) Coated Wire Mesh Gabions (8 x 10 mesh type)

1. Coating Thickness: Nominal 0.02 inch, minimum 0.015 inch.
2. Mesh Wire: Diameter 0.106 inch internal, 0.146 inch external.
3. Selvedge Wire: Diameter 0.134 inch internal, 0.174 inch external.
4. Mesh Opening: Nominal dimension D = 3.25 inches.

G. PA6 (Polymide 6) Coated Lacing Wire and Internal Stiffeners

1. Coating Thickness: Nominal 0.02 inch, minimum 0.015 inch.
2. Lacing Wire: Diameter 0.087 inch internal, 0.127 inch external.
3. Stiffener Wire: Diameter 0.087 inch internal, 0.127 inch external.

2.2 ACCESSORY MATERIALS

A. Overlapping Fasteners

1. Overlapping stainless steel fasteners (Spenax fasteners) may be used in lieu of lacing wire for basket assembly and installation. The spacing of the fasteners during all phases of assembly and installation shall be in accordance with spacing based on 1,200 lbs. pull apart resistance for PA6 coated mesh and with a nominal spacing of 4 inches, and not to exceed 6 inches.

2. Stainless Steel Fasteners: Diameter: 0.120 inch, according to ASTM A313, Type 302, Class I. Tensile strength: 222,000 to 253,000 psi in accordance with ASTM A313-92.

3. Proper installation of rings: A properly formed Spenax fastener shall have a nominal overlap of one (1) inch after closure.

2.3 TOLERANCES

A. Wire: Zinc coating, in accordance with ASTM A641, Class III soft temper coating.

B. Gabions: ± 5 % on the length, width, and height.

C. Mesh opening: Tolerances on the hexagonal, double twisted wire mesh opening shall not exceed ± 10% on the nominal dimension D values.

D. See paragraph 3.5F herein for installation tolerances.

2.4 FABRICATION, GENERAL

A. Gabions shall be manufactured with all components mechanically connected at the production facility. The front, base, back and lid of the gabions shall be woven into a single unit. The ends and diaphragm(s) shall be factory connected to the base. The lid may be a separate piece made of the same type mesh as the basket. All perimeter edges of the mesh forming the basket and top, or lid, shall be selvedged with wire having a

larger diameter. The gabion is divided into cells by means of diaphragms positioned at approximately 3 ft centers.

2.5 ROCK/STONE FILL

A. The rock for gabions shall be hard, cut, and angular stone, durable and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. Gabion rocks shall range between 6 inches and 10 inches. The range in sizes shall allow for a variation of 5% oversize rock, provided it is not placed on the gabion exposed surface. The size shall be such that a minimum of three layers of rock must be achieved when filling the gabions.

B. Stone for Gabion Site Wall

1. Type: Crushed rock, in rectangular dimensions for stacking

2. Size: 6 inches-10 inches, +5% oversize

3. Finish: Processed from scrap to size, free of dirt and fine material

4. Manufacturers/Suppliers:

a. Trap Rock by Tilcon, West Nyack, NY
b. Corinthian Granite by Champlain Stone, NY
c. or approved equal

2.6 AGGREGATE BASE

A. Broken stone, NYCDOT, Bureau of Highway Operations Standard Specifications, Section 2.02, Aggregate-Coarse, Type 1, Grade B, Sizes No. 1, No. 2 and No. 4. Provide aggregate course consisting of a uniform mixture of broken stone, Size Nos. 1 and 2, and add No. 4 as a filler after the coarser mixture has been rolled and compacted.

PART 3 EXECUTION

3.1 GRADE CONTROL

A. Establish and maintain lines and grades shown, by means of line and grade stakes placed at the jobsite.

3.2 EXAMINATION

A. Examine areas indicated for gabion walls, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that subgrade preparation, compacted density and elevations conform to the specifications and drawings.

C. Utilities and Structures: Verify that the locations of utility structures, appurtances and other surface features have been clearly marked or are visible.

D. Verify that the aggregate base materials, thickness, compaction, surface tolerances and elevations conform to the NYCDOT standards.

3.3 ASSEMBLY

A. Supply gabions folded flat and packed in bundles. Larger units may be supplied in rolls. Assemble units individually by erecting the sides, ends and diaphragms, ensuring that all panels are in the correct position, and the tops of all sides are satisfactorily aligned. Connect the four corners first, followed by the internal diaphragms to the outside walls. All connections should use lacing wire or fasteners as previously described.

B. The procedure for using lacing wire consists of cutting a sufficient length of wire, and first looping and/or twisting the lacing wire to the wire mesh. Proceed to lace with alternating double and single loops through every mesh opening approximately every 6 inches, pulling each loop tight and finally securing the end of the lacing wire to the wire mesh by looping and/or twisting.

C. Use fasteners in accordance with the manufacturer's recommendations.

3.4 INSTALLATION

A. After initial assembly, the Gabions are carried to their final position and are securely joined together along the vertical and top edges of their contact surfaces using the manufacturer's standard connecting procedure(s). Whenever a structure requires more than one layer, the upper empty baskets shall also be connected to the top of the lower layer along the front and back edges of the contact surface using the same manufacturer's standard connecting procedure(s).

3.5 FILLING

A. Fill gabions with rock specified. During the filling operation manual stone placement is required to minimize voids. The exposed faces of vertical structures must be carefully hand placed to give a neat, flat, and compact appearance. Rocks that are installed on the exposed face shall have a flat face and be parallel to the face of the gabion basket. Care shall be taken when placing fill material to ensure that the sheathing on the PA6 coated baskets will not be damaged.

B. Fill the cells in stages so that local deformation may be avoided. That is, at no time shall any cell be filled to a depth exceeding 3 inches higher than the adjoining cell. It is also recommended to slightly overfill the baskets to allow for settlement of the rock. Behind gabion walls, compact the backfill material simultaneously to the same level as the filled gabions.

C. Provide internal connecting wires when a structure requires layers of gabions to be stacked on top of each other. Internal Connecting Wires shall connect the exposed face of a cell to the opposite side of the cell. An exposed face is any side of a gabion cell that will be exposed or unsupported after the structure is completed. Lacing wire or prefabricated internal connecting wires may be used.

1. 3 feet high gabions shall be filled in three layers, 1-foot at a time.

2. Connecting wires shall be installed after the placement of each layer, that is, at 1-foot high and 2 feet high.

3. 1.5 feet high gabions do not require connecting wires unless the baskets are used to build vertical structures. In some cases, these units shall be filled in two layers, 9 inches at a time. Connecting wires shall be installed after the placement of the first layer, which is at 9 inches high. Appearance of connecting wires on face of baskets to be minimized.

D. Lid Closing: Once the gabion baskets are completely full, pull the lids tight until the lid meets the perimeter edges of the basket. The lid must then be tightly laced and/or fastened along all edges, ends and tops of diaphragm(s).

E. Mesh Cutting and Folding: Where shown on the drawings or otherwise directed by the Engineer, the gabions shall be cut, folded and fastened together to suit existing site conditions. The mesh must be cleanly cut and surplus mesh either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners. Any reshaped gabions shall be assembled, installed, filled and closed.

F. Gabion Basket Tolerances:

1. Vertical and Horizontal Seaming Alignment of Baskets

   a. Basket to Basket tolerance of seams shall be 1/2" maximum alignment.
   b. Top to Bottom of Gabion Wall of seams shall be 1/2" tolerance alignment.

2. Vertical and Horizontal Alignment of Gabion Wall

   a. Basket to Basket Alignment shall have a maximum of ½" tolerance of planar bulging of basket.
   b. From Top of Wall to Bottom of Wall, the Gabion Wall shall have a maximum of ½" tolerance for overall planar bulging of basket.

3. Exposed Internal Connecting Wire Alignments

   a. Exposed Internal Connecting Wire shall align horizontally and vertically. They shall be equally spaced and installed in a grid pattern.
   b. Each Exposed Internal Connection Wire Stay shall extend over three modules of the hexagonal weave of the gabion basket and shall have a square bend at each corner. The Exposed Internal Connecting Wire shall be flush against the face of the gabion basket.

3.6 ADJUSTING AND CLEANING

A. Repair damaged and defective work where possible to eliminate functional and visual defects; where not possible to repair, replace gabion site wall.

3.7 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that gabion site wall is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 044020

EXTERIOR STONE BOULDERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Exterior Stone Boulders as specified herein shall include, but not be limited to, the furnishing and placement of stone boulders both within and outside of wetland cells, and all accessories and appurtenances.

B. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Exterior Stone Boulders

C. 'Exterior Stone Boulders' shall be provided where shown on the Contract Drawings, specified in the Detailed Specifications, or as required for a complete installation.

1.3 RELATED SECTIONS

A. Project Specific Sustainability Requirements - Section 013010

B. Plantings For Wetland Areas – Section 327200

C. Soil Mixes For Wetland Areas - Section 327500

D. Aggregate Paving - Section 320516

1.4 REFERENCES

A. Except as modified by governing codes and by the Contract Documents, comply with the applicable ASTM provisions and recommendations.

1.5 SUBMITTALS

A. The Contractor shall submit the following Product Data:

1. Each type of Stone.

2. Quarry production schedule, indicating ordering, delivery, and mock-up dates and locations. Quarry to provide a written confirmation that they can meet the quantity of stone required.

B. The Contractor shall submit the following Samples for Approval:

1. Samples: Three samples of each stone type that are representative of the full range of color, grain, and texture of the material to be provided.

2. Samples and photographs: To represent the range of acceptable holes, tool or machine markings on the surface of the stone resulting from the process of stone extraction. If any holes, tool or machine markings will occur in the final selected stone, then they must be within the approved range.

C. After the Stone Samples have been approved, the Contractor shall coordinate Stone Selection with the Commissioner, see Paragraph 1.6D 'Quality Assurance; Stone Selection and Approval' herein. Commissioner shall approve a representative sample for each Class Size of Stone that represents material, shape, size, finish and the full range of color.

D. Delivery and Construction Schedule: Provide a detailed timeline calendar of significant dates for delivery of stone materials, accessories, equipment availability and installation dates. Clearly identify permits acquisition, potential conflicts, delays, impediments or obstructions and long lead delivery items.

E. Qualification Data: For firms specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

F. Construction Review: Submit method and techniques for construction of this Work, including, but not limited to quarry visit(s) for Commissioner to review and select stone, coordination schedules, delivery dates, mock-up assemblies, pre-installation assemblies, expected permits, equipment, materials, labor specialties and final installation.

G. A list of all temporary structures, barriers, braces and supports and their use during the installation of the work.

H. LEED Submittal Requirements

1. For all installed products and materials of this Section which are within the LEED boundary, complete the MATERIALS REPORTING FORM (blank copy attached at end of Detailed Specification 018113 – Sustainable Design Requirements). Information for this Form shall include:

a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Installer Qualifications: An experienced Stone Mason, with at least three (3) years of experience, who has completed Stone Masonry installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a successful in-service performance.

1. Be able to coordinate and install designed patterns as indicted on drawings and specifications and as directed by the Commissioner.

C. Source Limitations for Stone: Obtain each type of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

D. Stone Selection And Approval

1. The Contractor shall coordinate stone selection with the Commissioner.

2. Stone selection and approval shall occur at the approved quarry. The Contractor shall coordinate any site or quarry visit(s) for stone selection with the Commissioner.

3. Commissioner shall approve a representative sample for each Class Size of Stone that represents material, color, shape, size and finish. All installed stone to match the approved representative samples or be replaced at the Contractor's expense.

E. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on the Project site during times stone masonry installation is in progress.

F. Stone Boulder Mock-Up: Provide a Mock-up for each Boulder Type

Mock-up shall be a representative swath across the zones of each Boulder Type as defined in drawing L413 'Boulder Type And Key Plan'

1. Contractor to coordinate Mock-up with quarry and Commissioner.
2. Prior to mockup, present Mock-up methodology to Commissioner for approval.
3. Notify Commissioner not less than 10 business days in advance of dates and times when mockups will be constructed.
4. Provide any templates deemed necessary during the mock-up to give an accurate simulation of the site work conditions.
5. Document Mock-up assembly process to be repeated on construction site.
6. Mock-up will be used as basis to determine boulder placement and craftsmanship standard. Mock-up shall include the installation of gravel or soil around the base of the boulders, as described in the drawings.
7. Mock-up Size
    a. Mockup size to be typically 20' x 20'
8. Maintain Mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stone Delivery:

1. The contractor will be responsible to prepare a suitable place for delivery of stone.
2. If stone is delivered in loose bulk form on a dump truck the site must be prepare with gravel or other appropriate ground cover to dump stone.
3. It stone is delivered on pallets a suitable area must be arranged for storage of same. Deliveries of palletized material may require a forklift on the site to unload the truck.
4. Check with the supplier of the stone to find out what type of delivery can be arranged in your area and how much room will be required on the job site to deliver and place stone.
5. After stone is on the job site is should be covered with plastic or a tarp to keep clean and dry until it is ready to use. Using a tarp also helps to prevent vandalism.

6. Coordinate delivery of materials with other contractors, trades and disciplines as necessary.

B. Stone Delivery and Protection of Materials:

1. Materials shall be stored on site. To reduce damage, the length of time materials are stored should be minimized.

2. It is the responsibility of the contractor to maintain a ground cover of gravel or other suitable material under and adjacent to stockpiles and in all work areas to prevent mud splash.

C. Handling of Materials:

1. Materials shall be handled in such a way to avoid damage or breakage.

2. Boulder units shall be lifted using wide-belt slings. Pinch bars, wrecking bars, wire ropes, or ropes containing tar or other substances which might cause staining or damage shall not be used.

D. Rejection: units that are too small, too large, or of inferior quality will be rejected. Such items shall be removed from the site and not offered again for inspection.

1.8 PROJECT CONDITIONS

A. Cold-weather protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrate, surfaces or setting beds. Do not place epoxy grout or other bonding agents in temperatures below manufacturers recommendations.

B. Establish and maintain required lines and grades.

1.9 FINAL ACCEPTANCE

A. Contractor shall submit a written request to the Commissioner for a formal inspection of the stone masonry work for Substantial Completion.

B. At the time of inspection, all stones shall be free of cracks, seams, or other defects that could impair structural integrity. The Commissioner reserves the right to reject any stones that are deemed structurally unsound, damaged, located and/or oriented incorrectly, or not conforming to the visual design intent.

C. If stones need to be replaced, written notice will be given to the Contractor in the form of a punch list which itemizes all remedial work required to obtain Substantial Completion.

1.10 GUARANTEE

A. Guarantee all materials and workmanship for a period of one (1) year from Substantial Completion.

B. All of the materials and labor required for guarantee service of material during the warranty period shall be included in the Contractor's bid price.

C. If replacement stones are required, replacement work shall be completed within one (1) month from notification.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stone shall be as indicated on the Contract Drawings and as described in this Section.

B. Temporary Structures, Barriers, Braces, and Supports, as described in this Section.

2.2 STONE, GENERAL

A. Varieties and Sources: Subject to compliance with requirements, provide the stone specified for each stone type in Part 2.3 "Stone Boulders".

B. Match approved samples for material, variety, color and finish, and other stone characteristics relating to aesthetic effects.

C. Provide stone that is free of cracks, seams or other defects which may impair the structural integrity or function of the stone.

2.3 STONE BOULDERS

A. Type:

1. Stones shall be natural stone, as specified, and shall be cut, split or worked from sound and durable bluestone boulders. Stone shall be clean virgin stone and free of any and all contaminants.

B. Sources:

Subject to compliance with requirements, available stone varieties that may be incorporated into the Work include the following:

1. Local New York or Pennsylvania State Bluestone, as quarried by:

   a. Lilac Quarries, 617 State Hwy 51, Gilbertsville, NY 13776, (607) 867-4016
   b. Endless Mountain Stone Company, 5212 Brushville Road, Susquehanna, PA 18847 (570) 465-7200

   Or Approved Equal.

C. Finish:

1. Split Face

a. Holes, tool or machine markings on the surface of the stone are acceptable if they result from the process of stone extraction, but any marking must not exceed the extent of the approved sample and sample photographs.
b. No projections or depressions greater than 3-inches as measured from a straight edge the length of the stone.
c. No sharp or unsafe edges or surfaces.
d. Overall form to be roughly cubic, roughly rectangular in shape.
e. If contractor chooses to rework unacceptable stone to meet dimensional or finish requirements, the surface shall be hand worked as required with no tool or machine markings on the surface of the stone.
f. Finish all exposed surfaces. The finish of each stone to be within acceptable range of Commissioner's control sample.

D. Color:

1. Stone color to be grey-blue, blue, and lilac consistently throughout without unnatural color variation and with consistent grain and texture. Color variation outside of the approved sample range will not be accepted.

E. Grain:

1. Stones shall be fine to medium grained.

F. Material Standards:

1. Boulder Type: Bluestone (Quartzitic Sedimentary Sandstone from in New York and Pennsylvania)
2. Absorption – ASTM C97: Maximum 3%
3. Bulk Specific Gravity – ASTM C-97: Minimum 150 lb/cf density
4. Compressive Strength Perpendicular to the Grain - ASTM C170: Minimum 10,000 psi
5. Compressive Strength Parallel to the Grain - ASTM C170: Minimum 10,000 psi
6. Abrasion Index - ASTM C241: Minimum 8 Ha
7. Coefficient of Friction – ASTM C1028: 0.60 minimum wet and dry
8. Freeze-Thaw Resistance Testing – ASTM C-1026: No effect after 20 cycles (each cycle = previously soaked stone is kept 6-8 hours at 0 degrees F followed by soaking 16 hours in water at room temperature)
9. Wetting-drying, per USACE CRD-C169: 0.43% loss maximum and no major progressive cracking
10. Drop Test, from the height half the average diameter of the stone: No breakage or cracking
11. Set Aside Test: No breakage or cracking after one season cycle.

G. Sizes: All stone shall be cut, split or worked to shape in accordance with contract documents. Each length, width, and height size range shall be as indicated on the Drawings and in this Specification. No variation in the dimensions of any piece outside of this range shall be permitted. See Table 1

TABLE 1

STONE CLASS SIZES	LENGTH	WIDTH	HEIGHT	UNIT WEIGHT	DESCRIPTION
30-42"	30" min–42" max 30% - 30" min 40% - 36" range 30% - 42" max Or as approved by Commissioner	30" min–42" max 30% - 30" min 40% - 36" range 30% - 42" max Or as approved by Commissioner	30" min–42" max 30% - 30" min 40% - 36" range 30% - 42" max Or as approved by Commissioner	150 pcf	Boulders as described herein this specification and drawings. Roughly cubic or roughly rectangular shaped boulder with split face finish.

H. Quantity:

1. The quantity of stone will not be based on the quantity shown in the drawings, but shall be based upon the square footage area with the specified boulder sizes and layout dimensions as shown within the drawings.

2.4 APPROVAL

A. Commissioner shall approve selection of all stones.

B. Commissioner shall approve selection of all delivered stone for the Pre-Installation Assembly and on site.

2.5 TEMPORARY STRUCTURES, BARRIES, BRACES AND SUPPORTS

A. The Contractor shall provide any and all temporary structures, barriers, braces and supports necessary to safely accomplish the work at no additional cost to the City of NY.

B. The Contractor shall list all temporary structures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas indicated to receive dimensioned stone units for compliance with requirements for installation tolerances and for other conditions affecting performance of work in this Section.

B. Verify that the rough grade is at correct elevations.

C. Utilities and Structures. Verify that the locations of utility structures, appurtenances and other surface features have been clearly marked or are visible.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Contractor shall incorporate all necessary temporary structures, barriers, braces and supports necessary to safely accomplish the work, in a dry environment.

C. Finish stone at the approved stone quarry, prior to site delivery and final setting. Use appropriate equipment to shape stone to finished dimensions. Finish stone surfaces with slightly eased edges to prevent snipping. Hand finish stones on site only if necessary to avoid conflict and as directed by the Commissioner.

D. Set stone as indicated on Drawings or as directed by the Commissioner.

E. The Commissioner reserves the right to adjust pattern in the field to achieve the design intent.

F. Boulder Placement:

1. Boulder units shall be set as specified in the Contract Drawings.

2. Install boulders with the flattest area at the base.

3. In the wetland cells, the boulders will not have sharp angles. If the wetland liner is perforated during boulder installation, the Contractor will replace the entire zone of the wetland liner according to the directions of the liner manufacturer and Commissioner at no additional cost to the City of New York.

4. Individual boulders shall be shifted back and forth to establish a firm footing; once installed, the boulders shall not rock or move at all when pressure is applied.

G. Soil installation

1. Install planting soil as per drawings and specifications between the boulders. Finished grade of soil to be level around all boulders and compacted to an even grade prior to planting or seeding.

3.3 ADJUSTMENT, REPAIR, CLEAN UP AND PROTECTION

A. Boulders unit components which are dislodged, or excessively damaged by subsequent installation operations shall be immediately replaced with undamaged material in compliance with the Specifications and properly protected as specified.

B. Protect stone work from damage due to adjacent construction operations, other contractors, trades, and trespassers. Treat, repair or replace damaged work as directed.

C. Remove and replace stone units of the following description.

1. Broken, chipped, stained or otherwise damaged stone: may be repaired if methods and results are approved by Commissioner.

2. Stone Units installed at awkward or unnatural angles, as determined by the Commissioner.

3. Stone Units and spacing not matching approved samples and mock-ups.

4. Stone Units not complying with other requirements indicated.

D. Replace in a manner that results in stone work showing no evidence of replacement.

E. Cleaning: Clean stone work after installation is complete. Use procedures recommended by quarry for type of application.

3.4 DISPOSAL OF SUPLUS AND WASTE MATERIALS

A. Disposal: Remove all surplus and waste material, including stone, gravel, unsuitable soil, trash, and debris, and legally dispose of it off of the City of New York's property.

END OF SECTION

SECTION 044200

EXTERIOR STONE CLADDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor materials, equipment and services necessary to complete the exterior stone cladding as shown on the drawings and/or specified herein, including, but not limited to the following:

1. Stone panels, pieces, copings, soffits, sills and shapes as shown on drawings anchored to masonry and concrete back-up at job site.

2. Anchors, including slotted type, dowels, clamps, rods, hangers, clips, ties and bolts, and other fastening devices as required to securely anchor in place all the stone. Where such items are to be built-in or cast-in to the structure under other Sections, coordinate and ensure proper location of same.

3. Gutters, weep tubes, fittings, etc. which are necessary to establish a second line of defense for water control behind the stone system.

4. Drilling, fitting and cutting of stone work as required for the proper completion of the work.

5. Accessories and hardware required for complete installation.

6. Protection of stone during transit, storage, erection and after installation. Cleaning of stone prior to acceptance.

7. Coordination and provision for and interfacing with adjoining construction.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Masonry - Section 042000.

C. Sheet metal work - Section 076200.

D. Sealing of stone to stone joints - Section 079200.

1.4 LEED PERFORMANCE REQUIREMENTS

A. Mortar mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Structural steel (i.e. reinforcement bar, wire mesh, ladders) used in this section shall contain a minimum of 75% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with the DDC General Conditions.

C. Exterior stone cladding materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Section 018113, Materials Reporting Form, Article 1.06.

D. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of the DDC General Conditions VOC Limits Section where applicable.

1.5 PLANS AND SPECIFICATIONS

A. The stone cladding requirements shown on the Bid Drawing Set establish basic dimensions, profiles and sightlines. Within the limitations established by drawings and specifications, the Contractor is responsible for the design of the entire system. The standard systems must be capable of meeting all the specified performance requirements. Upon request provide test data that indicates the system(s) meets the specified performance requirements.

B. The design details do not cover all conditions that require solution. It is, however, intended that conditions not detailed shall be developed through the Contractor's shop drawings to the same level of aesthetics and in compliance with performance criteria, as indicated for detailed areas and stipulated in these specifications. The Contractor, by accepting a contract for the work, acknowledges this and agrees that the Commissioner shall have the final say as to all matters whether detailed or not on the design details.

1.6 QUALITY ASSURANCE

A. Installers

1. The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening have successfully completed in a timely fashion at least three (3) projects in similar scope and type to the required work.

B. Mason must demonstrate the following skills:

1. Be able to cut rubble stone with a hand set pitch and point. Must have had prior experience.

2. Be able to create designed patterns as dictated by Drawings and Specifications.

3. Have experience in setting stone in thinset mortar, keeping surface clean and free of cement at all times.

C. Stonework Foreman: Installation firm for stonework of this project shall have on staff a Supervising Foreman assigned full time to this Project, from time of mock-up installations, who shall have stonework installation experience.

D. Use numbers of skilled workmen equal to work requirement or occasion. The skilled workmen shall be thoroughly trained and experienced in the necessary crafts and shall be completely familiar with the specific requirements and methods needed for performance of the work in this Section.

E. The Contractor, by commencing the work of this Section, assumes overall responsibility, as part of his 1 year guarantee of the work, to assure that all assemblies, components and parts shown or required within the work of this Section, comply with the Contract Documents. The Contractor shall further guarantee:

1. That all components, specified or required to satisfactorily complete the installation, are compatible with each other and with the conditions of installation and expected use.

2. The overall effective integration and correctness of individual parts and the whole of the system.

3. Compatibility with adjoining substrates, materials and work of other trades.

4. There shall be no premature material failure due to improper design and fabrication of the stone. All materials are to fully perform to their normal life expectancy.

5. Each and every piece of stone shall be subject to the Commissioner's approval, and any piece or pieces which may be rejected after having been set shall be carefully cut out and replaced with new suitable stone without delay, and without cost to the City of New York. Any piece or pieces damaged in the removal and resetting of defective pieces shall also be removed, and suitable, approved pieces provided and set.

F. Commissioner's inspection of the stone does not relieve the Contractor from his responsibility to provide all stonework in accordance with the approved samples and shop drawings.

G. Examination Criteria: All examinations, selections and approvals shall be for the purpose of achieving a final appearance of stone with the greatest possible uniformity, and will be based upon the following criteria:

1. Color within approved, pre-selected color ranges and finish.

2. Sequence matching of adjacent stone units, as approved by the Commissioner.

3. Only one source of each type of stone shall be used throughout the work. Stone shall match the type, pattern, color, texture and finish of samples available for inspection in the office of the Commissioner.

4. Conformance to approved shop drawings and details within specified dimensions and tolerances.

5. Other criteria as specified in Part 2 - Products, herein.

1.7 TOLERANCES

A. Tolerances are as follows:

1. Joint dimension tolerance shall be -0", +1/8".

2. Variation from Plumb: For lines and surfaces of walls and arrises, +/- 1/8" protrusion up to maximum 1/2". For external corners, expansion joints and other conspicuous lines, do not exceed 1/8" in any story or 20 ft. max.

3. Variations from Level: For grades shown for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4" in any bay or 20'-0" maximum, nor ½" in 40'-0" or more.

4. Variation of Linear Building Line: For position shown in plan and related portion of grid lines, walls and partitions, do not exceed 1/2" in any bay or 20'-0" maximum; or ¾" in 40'-0" or more.

5. Offset at Joints: Do not exceed plus or minus 1/16".

1.8 PERFORMANCE REQUIREMENTS

A. Structural and Weather Resistance Requirements: The work, as erected, shall meet or exceed the following structural and weather resistance requirements, as demonstrated by engineering calculations.

B. Methods and fabrication and assembly (except as specified herein) shall be at the discretion of the Contractor provided that the visible architectural effect is not changed.

1. Set all walls with a straight plane face. Arris of all stones set at the plane face shall be plus or minus 1/8" protrusion forward up to ½" maximum.

C. Provision for Thermal Movements

1. The work shall be designed to provide for such expansion and contraction of component material, as will be caused by a surface temperature ranging from -20 deg. F. to +180 deg. F., without causing buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance or other detrimental effects.

2. The amount of such movement that is accommodated in the Contractor's design and method of accommodating it shall be identified on Contractor's submittal drawings, and shall be accompanied by thermal calculations.

D. Structural Properties: Minimum design wind pressures and seismic loads for the work acting normal to the plane of the surface of the work shall be those required by New York City Building Code.

E. Anchors

1. Adequate number and size of anchors shall be provided to satisfy the load requirements and design criteria set out in this specification. In any case, anchors shall not be less in size and number than shown on drawings, unless approved by the Commissioner.

2. Submit complete reports of load tests, conducted or witnessed by an Independent Testing Agency, for strength of all anchorage devices, prior to submitting shop drawings based on the use of such devices. Do not proceed without Commissioner's written approval of same.

F. Variations in Structure: The work shall be designed to accommodate variation in location of surrounding and supporting work, as defined as allowable variations in that work, as specified in other sections of the project specifications.

1.9 VISUAL INSPECTION OF FABRICATION AND INSTALLATION OF MATERIALS AND SYSTEMS

A. Visual Inspection of Fabrication and Installation of Materials and Systems: Prior to installing Work of this Section, construct each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Provide installation for visual inspection in location as indicated on the Drawings for approval by Commissioner for compliance with project design and quality requirements prior to commencement of additional work on specified system or component. The Commissioner reserves the right to request rectification of work deemed unsatisfactory.

2. Notify the Commissioner 7 days in advance of dates and times when installation will be constructed.

3. Make necessary adjustments in installation, as determined by Commissioner's review, and secure Commissioner's acceptance.

4. Maintain accepted installation of systems and components during construction in undisturbed condition as standard for judging completed Work.

5. Accepted sample installations in undisturbed condition at time of Substantial Completion may become part of completed Work.

6. Installation shall include the following elements: ST-03, ST-04, and ST-05, in locations, and to extent, as indicated on Contract Drawings. Installation shall be over specified back-up showing stone anchorage system, relationship to adjacent

construction, joint treatment, weeps, related flashing and all other accessories required to show how stone cladding will go together on the structure. Visual inspection of all elements shall happen concurrently for sign off by Commissioner before proceeding with additional work.

1.10 SUBMITTALS

A. Shop Drawings: Submit shop drawings for the fabrication and installation of all work and associated components. Include:

1. Wall elevations at 1/4" scale, typical unit elevation at 1" scale.

2. Show details of all conditions for every member, joint, anchorage and provision for expansion and contraction and joint treatment.

3. Include coordination details for related and adjoining work, insert drawings and erection diagrams. Show relative layout for all adjacent walls, beams, columns and slabs, all correctly dimensioned.

4. Special Conditions: Submit shop drawings for all special conditions on job including, but not limited to, pattern and protrusions of stone. Drawings shall illustrate piece sizes, protrusion of individual stones at corners, lintels, sills, and so on, relationships of end joints in wall pattern, thermal finished sawn 'L' corners, underside of lintels, and slopes at window sills.

B. Provide structural calculations, prepared in compliance with referenced documents and these specifications. Where specifications and code differ, the more stringent requirement shall govern. Calculations shall be legible and shall incorporate sufficient cross references to shop drawings to make the calculations readily understandable and reviewable. Calculations shall include the following information:

1. Analysis for all applicable loads on framing members and miscellaneous support steel.

2. Analysis for all applicable loads on anchors, including anchors embedded in concrete.

3. Section property computations for steel framing members.

4. Analysis of stress in stone and required safety factors.

5. Seal and signature of Professional Engineer registered in the State of New York.

C. Review of calculations and shop drawings by the Commissioner will not relieve the Contractor of any responsibilities for providing a system within the required performance requirements. If the structural calculations indicate any deficiencies, the Contractor shall, at his expense, provide all items necessary to comply with the performance requirements.

D. Submit complete Cutting and Setting Drawings to Commissioner for approval. Shop sizes, shapes, thicknesses, jointing, anchoring, connection with other work, typical and special anchoring details, supports, dimensions, setting numbers, and color range for each piece of stone. Clearly indicate dimensions for locating slots in stone and for

locating inserts to be built into concrete and masonry. Do not fabricate any stone (except for samples) until shop drawings have been approved by the Commissioner.

E. Manufacturer's Data

1. Submit copies of manufacturer's specifications and installation instructions for each stonework accessory required. Include data substantiating that materials comply with specified requirements. Indicate that installer has received copy of manufacturer's instructions.

F. Test Reports: Submit written, certified test reports for required tests, recording dates, locations, method of testing, test results and interpretation of results.

G. Samples

Size	Description
18" x 18"	Each stone type with finish each kind and color (note: Submit four (4) sets of color range/stone variation samples for each finish)
Actual	Stone anchoring devices, shims, each type and kind

H. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

3. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.11 DELIVERY, STORAGE AND HANDLING

A. Protect stone during storage and construction against moisture, soiling, staining, and physical damage.

B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might cause staining. If required, use wood rollers and provide cushion at end of wood slides.

C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stone.

D. Protect mortar materials and stonework accessories from weather, moisture, and contamination with foreign materials.

1.12 JOB CONDITIONS

A. Installer must review installation procedures and coordination with other work with Contractor and other subcontractors whose work will be affected by stonework.

B. Environmental Requirements:

1. Hot Weather Requirements: Protect stone work when temperature and humidity conditions produce excessive evaporation of water from mortar setting beds and joint grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply setting mortar or joint grout to substrates with temperatures of 100 deg. F. (38 deg. C.) and above.

2. Cold Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen surfaces or setting beds. Remove and replace stone work damaged by frost or freezing conditions. Comply with cold weather limitations and requirements specified herein:

   a. Protect stone material and components against freezing when atmospheric temperature is 40 deg. F. and falling. When conditions require, heat materials to provide mortar and grout temperatures between 40 and 120 deg. F.
   b. Provide the following protection for completed portions of work for 24 hours after installation when the mean daily air temperature is as indicated: below 40 deg. F, cover with weather resistant membrane; below 25 deg. F, cover with insulating blankets; below 20 deg. F., provide enclosure and temporary heat to maintain temperature above 32 deg. F.
   c. Maintain minimum ambient temperatures of 50 deg. F. during installation of stone and for 7 days after completion, unless higher temperatures are required by fabricator's or supplier's instructions.

3. Cold Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg. F. (4 deg. C.) and above and will remain so until stone has dried out, but not less than 7 days after completing cleaning.

1.13 PROTECTION

A. Protect adjacent surfaces from damage. Protect exposed surfaces of stone units from damage or defacement. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction.

B. Protect all stonework from other materials that will cause staining or defacement. Stone subject to damage after setting shall be properly covered or protected.

C. No lumber or other material liable to stain or deface the stone shall be used.

PART 2 PRODUCTS

2.1 STONE

A. ST-03, ST-03a: Exterior Stone Cladding – Concrete.

B. ST-04: Exterior Stone Cladding to Doors.

C. ST-05: Stone Masonry (Site Stone) as scheduled. Refer to Dwg. CROB_A_218.

D. ST-09: Stone Masonry (Site Stone) as scheduled. Refer to Dwg. CROB_A_218.

E. ST-10: Cap Stone: Split-face swan top, bottom, and ends, natural cleft front (East Façade), back finish to match ST-09 (West Façade). Refer to Dwg. CROB_A_218.

Dwg code	Location	Type	Dimension	Finish	Construction
ST-03a	Clubhouse Exterior Cladding	Mixed bar and long veneer bar	nom 4" high 4" deep 24" - 48" long 1" projection	Split face, sawn top, bottom, ends, natural cleft front and back, thermal finish to exposed under side and jambs	Dry Stack with Type S mortar set back 1" from face, SST anchor fix
ST-03b	Sloped Clubhouse Exterior Cladding	Mixed bar and long veneer bar SLOPED Installation to follow roof profile	nom 4" high 4" deep 24" - 48" long 1" projection	Split face Sawn top, bottom, ends, natural cleft front and back, thermal finish to exposed under side and jambs	Dry Stack with Type S mortar set back 1" from face, SST anchor fix

ST-04	Clubhouse Exterior Cladding on Door	Stone veneer to match adjacent wall and surrounding building stone cladding.	nom 4" high 1/2" deep 24" - 48" long No projection	Split face Sawn top, bottom & ends, natural cleft front and back, thermal finish to exposed under side and jambs	Epoxy and mechanically fastened to HM door. Alignment to match adjacent stone.

F. Manufacturers

1. New York Quarries Inc. 305 Rte. 111, Alcove, NY 12007 (518) 756-3138
2. Helderberg Bluestone & Marble 43 Old Rd. East Berne, N.Y. 12059 518-872-0242
3. Pacama Bluestone 924 Lapla Rd. Kingston N.Y., 12401 845-334-8906
4. or approved equal.

G. Stone Masonry Units: As indicated in stone masonry units schedule, and as follows:

1. Provide Alcove Bluestone by New York Quarries or approved equal.
2. Atomic Absorption Analysis:

a.	Calcium Oxide:	2.43%
b.	Magnesium Oxide:	1.13%
c.	Silica Dioxide:	74.91%
d.	Iron Oxide:	4.54%
e.	Aluminum Oxide:	8.58%
f.	Sodium Oxide:	96%
g.	Potassium Oxide:	1.5%
h.	Loss on Ignition:	2.43%

3. Physical Properties:

a. ASTM C97, Absorption and Bulk Specific Gravity: 168.35 Av.
b. ASTM C170, Compressive Strength: 35,000 psi parallel to grain; 24,250 psi perpendicular to grain.
c. ASTM C99, Modulus of Rupture: 2,245 psi parallel to grain; 2,742 psi perpendicular to grain.
d. ASTM C241, Abrasion Resistance:

1).	Natural Cleft Surface:	36.4
2).	Thermaled Finish:	33.74
3).	Honed Finish:	41.38

H. Mortar Materials: ASTM C207, Type S. Sand conforming to ASTM C144. Potable water clean and free from acids, alkalis, organic material, minerals and salts.

I. Finishes

1. Thermal: Stone shall have natural cleft faces on all exposed surfaces when possible. All exposed manufactured surfaces to be "thermalled"; concealed surfaces may be sawn. Edges to receive grout or sealant shall be sawn.

2. Honed: Stone shall have "honed" finish on all exposed surfaces; concealed surfaces may be sawn. Edges to receive grout or sealant shall be sawn.

3. Polished: Stone shall have polished finish, mirror glass with sharp reflections, on all exposed surfaces. Concealed surfaces may be sawn.

2.2 GENERAL STANDARDS

A. Quarrying Supervision

1. Quarrying shall be supervised and coordinated by the stone fabricator to insure that the as-quarried block orientations will yield finished material with characteristics as described herein.

2. All stone shall be cut from matched blocks. Matched blocks shall mean blocks extracted from a single bed of stratum in the quarry. The use of blocks chosen at random, though similar in general character and color to that of the approved stone shall not be permitted, except by written permission of the Commissioner.

B. Examinations

1. Examination at the Quarry: Quarried blocks shall be made available for inspection by the Commissioner at his request.

2. Examination at the Fabrication Plant: Production units shall be made available for inspection by the Commissioner at his request. To this end, the Contractor shall, after approval of final shop drawings, advise the Commissioner when production has begun and of the earliest possible opportunity to inspect a representative sampling of production work.

3. Contractor shall provide lighting that is sufficient in intensity and color range to permit an adequate examination to the satisfaction of the Commissioner.

C. Criteria for Stone

1. Visual: All examinations, selections, and approvals shall be for the purpose of achieving a final appearance of stone with greatest possible uniformity, and will be based upon the following criteria:

   a. All stone shall be of sound stock and uniform texture, and shall be free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects which would impair the strength, durability, and appearance of the work, as determined by the Commissioner.
   b. Inherent variations characteristic of the stone and the quarry from which the stone is to be obtained shall be brought to the attention of the Commissioner at the time the samples are submitted for approval, and shall be subject to approval of the Commissioner.
   c. All stone shall be selected for background color, veining, marking and matching, shall run in even shades, and shall be set accordingly.

D. All engineering calculations and design shall be based on the mechanical and physical properties of the stone. Performance data for these properties shall have been derived by the Contractor from tests using a min. of 5 specimens prepared from different blocks. Contractor to submit data to the Commissioner.

1. Absorption and Bulk Specified Gravity (ASTM C97)

2. Flexural strength (ASTM C880)

3. Compressive Strength (ASTM C170)

4. Modulus of Rupture (ASTM C99)

5. Weathering (ASTM C666) modified for building stone; use Procedure A modified as follows:

   a. The stone shall be immersed in water during freezing cycles (0 deg. F.) and dry during thawing and heating cycles (+ 160 deg. F.).
   b. At the end of 300 cycles, the specimens shall be tested in flexure (ASTM C880).
   c. After each period of cycles (10, 20, 40, 80, 160, 300), the specimens shall be visually evaluated, lightly brushed and weighed. The loss of weight shall be part of the test procedures, and shall be included in the report.
   d. Stone shall be evaluated after the weathering test to determine if there are cracks, scaling, discoloration and breakage.

2.3 INSTALLATION MATERIALS

A. Stone Support System(s)

1. Furnish all anchors, cramps, dowels, tiebacks, fastening devices, supports, and the like fitting hardware as necessary to properly secure stone units. Types to be approved, of sizes and shapes to fit each particular support condition encountered. Metal components shall be stainless steel, Type 304, nonmagnetic.

2. Lead or plastic buttons used shall be of the thickness required for the joint size shown or as specified, and of the size required to maintain a uniform joint width and meet the load requirements of stone installation condition.

3. Support components, anchors, fastening devices, and accessories shall be manufactured by a Commissioner approved company or companies specializing in the design and fabrication of stone support systems. Sizes and thicknesses of all components shall be determined and/or confirmed by engineering calculations for each condition of stone material type, loading, applied external forces, and use. Provide sizes not less than shown.

   a. Sheet, Bar and Plate: ASTM A-666, Type 304.
   b. Fasteners, Anchor Bolts, Nuts and Washers: AISI Type 304, non-magnetic, ASTM A167.
   c. Shims: AISI type 304.

B. Mortar Materials

1. White Portland Cement: ASTM C 150, Type 1, non-staining. Cement shall in no case contain more than 0.03% by weight of soluble alkali (calculated as Na_2O). Submit mill certificates of cement and certified analysis from an approved testing laboratory.

2. Sand: ASTM C 144, except graded with 100% passing No. 16 sieve, non-staining.

3. Hydrated Lime: ASTM C 207, Type S.

4. Water: Potable, clear and free of deleterious materials which would impair the quality of the mortar.

5. For colored pointing mortar, provide integral, non-fading colorant; color as selected by the Commissioner.

C. Tubes for venting and weeping shall be No. 341, ¼" o.d. plastic tubing made by Hohmann & Barnard or approved equal.

D. Flashing: See Section 076200, Sheet Metal Flashing and Trim.

2.4 CUTTING, DRILLING AND FITTING

A. Provide holes and sinkages required for anchors, dowels, other devices required to support and/or suspend stone, and to accommodate other items which connect to or penetrate the stone.

B. Include all cutting, drilling and fitting of stone work required to accommodate the work of other trades. In cutting and fitting, carefully cut and grind edges to a neat tight fit. Do cutting in such manner so as not to impair strength or appearance of stone. Use physical templates for all cutting and drilling; obtain required templates from proper trades.

C. Anchoring: Field cutting of the stone is necessary to receive specified anchors. Work includes drilling holes, saw cutting slots, and/or grinding grooves (or a combination of these) into stone at locations specified to receive the anchors.

PART 3 EXECUTION

3.1 EXAMINATION OF STRUCTURE

A. Examine all parts of the supporting structure and the conditions under which the stonework is to be installed, and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation of stonework until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Review installation procedures and coordinate with other work, and with other trades whose work will be affected by the stonework.

C. Advise other trades of requirements relating to their placement of any inserts which are to be used for anchoring and supporting of stonework.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Lines and Grades: Benchmarks for elevations and building line offset marks for alignment shall be established on each floor level by the Contractor, who shall be responsible for their accuracy. Should any error be found in their location, the Installation Contractor shall so notify the Contractor in writing and installation work shall not proceed in the affected areas until the errors have been corrected.

B. Workmanship: All parts of the work shall be erected plumb and true, in proper alignment and relation to established lines and grades, and as shown on approved shop and/or erection drawings.

C. Visible Mortar left after installation shall be completely cleaned from the work within 2 days of setting.

D. Erection Tolerances

1. Permissible dimensional tolerance in the building frame and/or work surrounding or supporting the work of this Section are stated in the appropriate Trade Sections of these Specifications.

2. The work shall be designed to accommodate all tolerances and anticipate dead and live load movement, creep, sway and torsion of the structure without any harmful effects.

3. Refer to Article 1.7 herein for stone erection tolerances.

E. Do not use stone units with chips, cracks, voids, stains or other defects which might be visible in the finished work. Patching or hiding defects in stone will not be permitted.

3.3 INSTALLING SAWN TOP AND BOTTOM AND END VENEER, NATURAL CLEFT FRONT AND BACK

A. Field cut veneer lengths, sills, lintels and corners as required.

B. Select cut shapes for proper protrusion as indicated in approved shop drawings.

C. Use specified multi-purpose thin set mortar (tinted black). Spread mortar 1/16" to 1/8" between stone, staying back from front edge. Set stone leaving exposed face free of mortar. Finish joint 1/16" to 1/8" maximum. Remove any mortar immediately that may come forward on the face with sponge and clean water. Avoid excess coming forward as much as possible. Finish joint clean and free of all mortar giving the stone a dry-laid appearance. Keep stone face free of mortar at all times. Contractor is responsible for weather protection, freeze/thaw, rain, and so on.

D. Pattern and Protrusions of Stone

1. Submit shop drawings for all special conditions on job. Drawings shall illustrate piece sizes, protrusion of individual stones at corners, lintels, sills, and so on, relationships of end joints in wall pattern, thermal finished sawn 'L' corners, underside of lintels, and slopes at window sills.

2. Set all walls with a straight plane face. Arris of all stones set at the plane face shall be plus or minus 1/8" protrusion forward up to maximum per drawings.

3.4 SETTING STONE

A. Installation of Natural Stone Veneer

1. Anchoring: Field cutting of the stone is necessary to receive specified anchors. Work includes drilling holes, saw cutting slots, and/or grinding grooves into stone at locations specified to receive the anchors.

2. Field cut rubble stone to fit the requirements within the Drawings and Specifications.

3. The space openings between stones shall not exceed 1/2 inch on horizontal and vertical joints.

4. Use specified black Type S mortar only.

5. Keep mortar back from the arris of the finished face by 1 inch.

6. Keep stone face free of mortar at all times. The Contractor is responsible for weather protection, freeze thaw, rain, and so on.

7. Pattern of the Rubblestone:

   a. Follow patterns as shown on the Drawings.
   b. Field cut rubble stone to fit the requirements within the Drawings and Specifications.
   c. Select stones in the field to "fit" and "flow" with the pattern as shown.
   d. Hand trim the stone where necessary.
   e. Set all walls with a straight face. Set the arris of all stones at the face plane, plus or minus 1/4 inch.
   f. Set protrusion stones forward of the face plane to the maximum required in the Drawings and Specifications.
   g. At the Commissioner's direction, adjust the pattern and/or protrusions top achieve the design required.

8. Fix drainage board to concrete face.

9. Set stone out from top of wall down and follow contour of coping stone.

10. Locate dovetail stainless steel anchors at 16 inches wide x 16 inches high centers.

11. Use Type S mortar, laid wet to look dry.

12. Install with maximum 1/2 inch projection to stone face for anticlimb.

B. For installation of stone below water

1. The water drainage mat should stop above the waterline, end joints above the water line for a height of -6" should be empty with no mortar plus or minus every 2'-0".

2. All the joints below the waterline should be full of mortar (S mortar, the same as is used for the other parts of the wall is acceptable)

3. The back of the stone to the wall must be filled with mortar, no voids anywhere

4. Ensure all anchors are in place in the minimum quantity, and it is good to have more than not enough

C. Stone veneer shall be epoxy and mechanically fixed to steel door. Stone veneer shall be custom cut around door hardware and not lock hardware in place and shall allow hardware to be changed out in the future without removal of stone.

3.5 PROTECTION OF STONEWORK

A. Prevent materials used for installing work of this Section from staining or damaging the exposed surfaces of stone units or the exposed surfaces of the adjoining construction. Immediately remove mortar, grout or other detrimental materials from exposed surfaces of stone or adjoining construction.

B. During installation, cover tops of walls and projections with waterproof sheeting at the end of each day's work. Cover partially completed stonework when construction is not in progress.

C. Protect all stonework from other materials that will cause staining or defacement. Stone subject to damage after setting shall be properly covered or protected.

1. Protect base of walls from rain-splashed mud and mortar splatter by covering spread on the ground and over the wall surface.

2. Lumber or other material liable to stain or deface the stone shall not be used in contact with stone.

D. Provide additional protection for finished work such as exposed edges, corners, and all other stone liable to physical injury or staining. Protection shall include but is not limited to non-staining approved coverings, and clean non-staining wood boxing. All fastenings or hold-back devices shall be stainless steel. Fastening to stone joints is prohibited.

E. At completion of construction work, remove all temporary protection installed as work of this Section.

F. After installation, protect stonework from damage during subsequent construction activities.

3.6 ADJUSTING, CLEANING, AND REPAIRING

A. Examine all work and repair all damage. Clean soiled or stained surfaces. In the event damage is irreparable, or soiled or stained surface cannot be cleaned, then remove and replace such items at no additional cost to City of New York.

B. Remove and replace stonework of the following description:

1. Defective, broken, chipped, stained, or otherwise damaged stone units installed as work of this Section.

2. Unfilled or defective joint.

3. Stone masonry and joints not matching approved samples and mockups.

C. Replace in manner that results in stonework matching approved samples and mockups.

D. In-Progress Cleaning: Clean stonework as work progresses. Remove mortar fins and smears before tooling joints.

E. Final Cleaning: After setting mortar and, as applicable, mortar is thoroughly set and cured, clean stonework as follows:

1. After completion of any repair work, clean exposed surfaces of all stone surfaces and units installed as work of this Section with clean water and stiff fiber brushes until all dirt, stains, efflorescence, mortar, and other defacements are removed. Use cleaner and procedures recommended by stone quarry and stone fabricator and approved by Commissioner. Do not use wire brushes, metal scrapers or acids. Protect adjacent surfaces from damage during cleaning operations.

2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

3. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Commissioner's approval of sample cleaning before proceeding with cleaning of each area or element of stonework.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Prefabricated building columns.
3. Grout.

1.3 RELATED SECTIONS:

A. DDC General Conditions

B. Section 051213 - Architecturally Exposed Structural Steel (AESS)

C. Section 053100 - Steel Decking

D. Section 099000 – Painting and Finishing

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P3 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site.

1.5 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches (38 mm).
2. Welded built-up members with plates thicker than 2 inches (50 mm).
3. Column base plates thicker than 2 inches (50 mm).

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.6 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator including comprehensive engineering analysis by a qualified professional engineer to withstand loads indicated and comply with other information and restrictions indicated. Submit all information to the Commissioner for review and approval prior to the start of work.

1. Select and complete connections using schematic details indicated and AISC 360.
2. Use LRFD; data are given at ultimate-load level.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of moment frame and shear walls

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at the end of Section 018113 Sustainable Design Requirements). Information to be supplied for this Form shall include:
      a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
      b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
      c. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

C. For all field-applied adhesives, sealants, paints, and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

D. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

E. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

F. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

G. Shop Drawings: Show fabrication of structural-steel components.

   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

H. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint, whether prequalified, including the following:

   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand critical welds.

1.8 SUBMITTALS

A. Qualification Data: For qualified Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Source quality-control reports.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided City of New York's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.10 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.11 LEED PERFORMANCE REQUIREMENTS

A. Structural steel (i.e. reinforcement bar, wire mesh, ladders) used in this section shall contain a minimum of 75% (combined) pre-consumer/post-consumer recycled content (the percentage

of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with the DDC General Conditions.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of the DDC General Conditions, where applicable.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M .

B. Channels, Angles-Shapes: ASTM A 36/A 36M

C. Materials complying with first option in first paragraph below are widely available; those complying with second option are less so. Third option is a specialty-steel material; verify availability if required.

D. Plate and Bar: ASTM A 572/A 572M, Grade 50

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Grade B.

G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts[or tension-control, bolt-nut-washer assemblies with splined ends]; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip or mechanically deposited zinc coating.

2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1 assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.

1. Nuts: ASTM A 563 (ASTM A 563M) [heavy-]hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

G. Threaded Rods: ASTM A 36/A 36M

1. Nuts: ASTM A 563 (ASTM A 563M) [heavy-]hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.

H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 PRIMER

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Primer: Comply with all Sections dealing with Painting and Finishing, Interior Painting, High-Performance Coatings, and Exterior Painting. Primer shall be compatible with, and from the same manufacturer as, top coats specified by the Architect. Surface preparation as per primer manufacturer's recommendation..

C. Zinc-rich Primer: Inorganic zinc rich meeting AISC class B surface requirements for slip critical connections. Primer shall comply with all federal standards for VOC, lead and chromate levels. Provide manufacturer's certificate of compatibility with fire proofing coating.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

F. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches (250 mm) o.c. unless otherwise indicated.

H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize steel per requirements of the contract drawings.

2.9 SOURCE QUALITY CONTROL

A. Fabricator shall be an AISC Certified Fabricator.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in

intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges." For architectural exposed structural steel follow the requiremetns of specification 51213 – "Architectural Exposed Structural Steel" as appropriate.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated or if appitional splices are required clearly indicate on shop drawings.

F. Do not use thermal cutting during erection unless approved by Commissioner, Architect and Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Pretensioned.

B. Weld Connections: Comply with AWS D1.1/D1.1Mfor tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency for Special Inspection: City of New York will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 099000 "Painting and Finishing."

3.7 ARCHITECTURAL EXPOSED STRUCTURAL STEEL

A. All steel noted as architectural exposed structural steel, AESS or is exposed steel in a public accessible space shall be treated as Architectural Exposed Structural Steel and shall be fabricated and installed in accordance with Specification – 051213 Architectural Exposed Structural Steel.

END OF SECTION 051200

SECTION 051213

ARCHITECTURALLY EXPOSED STUCTURAL STEEL (AESS)

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of the contract documents.

B. This section includes requirements regarding the appearance, surface preparation and integration of Architecturally Exposed Structural Steel (AESS) only.

C. For technical requirements, refer to the other Subsections of Division 5 "Structural Steel" Section. This Subsection applies to any structural steel members noted on Structural Design Documents as AESS. All AESS members must also be identified by their AESS Category.

1.2 RELATED DOCUMENTS

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Structural steel work designated as architecturally exposed

B. Related work specified elsewhere:
1. Section 013010 - General Conditions - LEED Certification Requirements
2. Section 014000 - General Conditions - Quality Assurance Reference Mockups
3. Section 018113 - Sustainable Design Requirements
4. Section 051200 - Structural Steel Framing
5. Section 053100 - Steel Decking
6. Section 055020 - Weathering Steel
7. Section 099000 - High-Performance Coatings

C. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

D. For definitions of Categories AESS 1, 2, 3, 4, and C as listed in the AESS Matrix (see Table 1)

1.3 SUBMITTALS

A. General: Submit each item below according to the DDC General Conditions.

B. Shop Drawings and Calculations signed and sealed by a Professional Engineer licensed in the State of New York detailing fabrication of AESS components:

1. Provide erection drawings clearly indicating which members are considered as AESS members and their specified AESS Category;

2. Include details that clearly identify all of the requirements listed in sections 2.3 ''Fabrication'' and 3.3 ''Erection'' of this specification. Provide connections for AESS consistent with concepts, if shown on the Structural Design Documents;

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein;

4. Indicate type, finish of bolts. Indicate which side of the connection bolt heads should be placed; use flathead fasteners, rear face studs, zero-clearance locating pins or other low visibility / tight tolerance fasteners to the greatest extent possible

5. Indicate any special tolerances and erection requirements.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section which are within the LEED boundary, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information for this Form shall include:

a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

1.4 QUALITY ASSURANCE

A. Erector Qualifications: In addition to those qualifications listed in other Subsections of Section 051200 "Structural Steel Framing", the contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

B. Recommended Fabricators:

1. Mariani Metals – Etobicoke, ON, Contact Vince Mariani 416-798-2969

2. Penn Fab Inc. – Bensalem, PA, 215-245-1577

3. Approved Equivalent

C. Comply with applicable provisions of the following specifications and documents:

1. ASTM A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling, latest edition

2. AISC Code of Standard Practice, latest edition.

3. AWS D1.1 "Structural Welding Code", latest edition

4. SSPC Painting Manual, latest edition

5. SSPC Surface Preparation Specifications and Practices, latest edition

D. Visual samples shall include the following:

1. Physical sample of surface preparation and welds using material of full thickness and weld procedures and positions identical to production

2. First off inspection: First element fabricated for use in finished structure subject to alterations for subsequent pieces. This inspection may also be considered the inspection of the full scale mock-up.

3. Mockups: Full- scale Mockups are to demonstrate aesthetic effects as well as qualities of materials and execution:
   a. Mockups shall have finished surface (including surface preparation and paint system);
   b. Commissioner's approval of mockups is required before starting fabrication of final units;
   c. Mockups are retained until project is completed;
   d. Approved full-scale mockups may become part of the completed work.
   e. Provide one mockup for each of the following project components as indicated in the contract documents: 1. Phase B Tee Box Structure 2. Phase B Tee Box Lighting Masts 3. Phase B Clubhouse Tapered Steel Column 4. Phase A Cart Path Netting Barrier System

1.5 DELIVERY, STORAGE, AND HANDLING

A. Ensure that all items are properly prepared, handled and/or packaged for storage and shipping to prevent damage to product.

1. Erect finished pieces using threaded eyes, softened slings or other methods such that they are not damaged. Provide padding as required to protect while rigging and aligning member's frames. Weld or bolt tabs for temporary bracing and safety cabling only at points concealed from view in the completed structure or where approved by the Commissioner. Provide thorough site protection to AESS finishes immediately after installation, including abrasion resistant self-adhering plastic wrap to surfaces in trafficked areas. Provide more abrasion resistant protection as need, such as temporary plywood covering.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Bars and Plates

1. Steel Plate, Bars, Solid Rounds and Hexagons: ASTM A36

2. W Shapes: ASTM A992

3. M, S, L, C and MC Shapes: ASTM A36

4. HSS Shapes: ASTM A500 Grade B.

5. HP Shapes: ASTM A572 Grade 50.

6. Pipe: ASTM A53 Grade B

7. Stainless Steel: ASTM AISI 316L

B. Structural Fasteners

1. High Strength Bolts: ASTM A325 or F1852.

2. Common Bolts: ASTM A307 Grade A

3. Shear Studs: A108

4. Anchor Bolts: ASTM F1554 Grade 36

5. Stainless Steel Fasteners: ASTM F593C or F593D (AISI 304CW1 or CW2).

C. Weld Materials

1. All welding electrode shall be the appropriate matching filler for the metal specified or as specified on the contract documents.

2. All welding electrode shall be low hydrogen type.

3. Non-fusible backing bars shall be used whenever possible on exposed AESS Surfaces.

2.2 SPECIAL SURFACE PREPARATION

A. Surfaces that are to be painted or filled must be cleaned using steam or hot water in conjunction with tri-sodium phosphate (TSP) or other similar cleaning agent.

B. Primers: See Architectural Drawings and:

1. Section 099000 – Painting and Finishing

C. Paint System: See Architectural Drawings and:

1. Section 099000 – Painting and Finishing

D. Epoxy Filler: Product data, application procedure, location and anticipated thickness of filler as recommended by finishing manufacturer must be submitted for approval prior to commencement of work.

E. Painting of Steel Section Interior: For any AESS section exposed to weather and not completely welded shut, paint interior of steel section.

2.3 MATERIAL SELECTION AND PREPARATION

A. Materials to be used in the structure shall be selected for visual criteria, straightened in advance of cutting, or straightened during the fit up process. Material used shall be free of visual defects such as pits, rolled in scale, roll marks or waves, gouges, inclusions, lamination failures, clamp marks, hammer marks, etc.

2.4 FABRICATION

A. For the special fabrication characteristics, see Table 1 – AESS Category Matrix of this specification. Structure to meet the AESS requirements as specified on the construction drawings. All hollow metal members exposed to weather and not completely welded shut shall have weep holes and shall be primed or galvanized on the interior.

B. Fabricate and assemble AESS in the shop to the greatest extent possible. Locate field joints in AESS assemblies at concealed locations approved by the Commissioner. Avoid field welding. Use concealed bolting or concealed field welds.

C. Fabricate AESS with surface quality consistent with the AESS Category specified on the construction drawings and visual samples as applicable.

D. Transitional grinding of material which has not had the scale removed on flat or gently curved exposed surfaces is not permitted.

E. The use of aids such as clamps, jigs, fixtures and strong backs is required during fit up and welding so as to ensure the work remains geometrically true and straight so as to ensure that

sweet lines are achieved throughout the workpiece after welding is complete. When possible jigs, clamps, etc. shall incorporate copper or aluminum bars to conduct heat away from the weld area.

F. The use of filler is not permitted in thicknesses greater than 1/8" and shall be applied only to freshly sandblasted steel and shall be covered by a primer / paint suitable for both filler and base material. Filler to be as recommended by manufacturer. Apply filler only after application of approved primer per manufacturer's instructions, do not apply filler to bare steel.

G. Cold rolled material should be used to the greatest extent possible.

2.5 SHOP CONNECTIONS

A. Bolted Connections: Bolted connections shall be concealed unless otherwise noted. Make in accordance with Section 051200. Provide bolt type and finish as specified and place bolt heads as indicated on the approved shop drawings.

B. Welded Connections: Comply with AWS D1.1, Section 051200 and this specification. Appearance and quality of welds shall be consistent with the AESS Category specified and the visual samples as applicable. Assemble and weld built-up sections by methods that will maintain alignment of members to the tolerance of this Subsection.

1. The lowest heat input with the commensurate weld process shall be used.

2. Welded connections between components shall be designed so tensions due to shrinkage are balanced. Materials shall be pre-heated as required prior to welding so as to avoid locked-in thermally-induced warpage.

3. Welds to be dressed and shall be executed in a suitable rotation (tacking and stitch welding) or in such a sequence (multi-pass) so as to avoid thermally-induced and asymmetrical stress accumulation.

PART 3 EXECUTION

3.1 EXECUTION

A. The erector shall check all AESS members upon delivery for twist, kinks, gouges, scratches, rust, paint finish unevenness, discoloration or mottling or other imperfections, which might result in rejection of the appearance of the member. Any correction required for unacceptable finish shall be completed in the finisher's shop, and the rejected member(s) shall be immediately returned to said shop and refinished at no additional cost to City of New York. Any correction and fixes to the structure to correct visual imperfections which occurred after the initial visual acceptance outlined in Section 2.7, shall be remediated at no cost to the City of New York.

3.2 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on the approved shop erection drawings. Temporary connections shown shall be made at locations not

exposed to view in the final structure or as approved by the Commissioner. Handle, lift and align pieces using padded slings and / or other protection required to maintain the appearance of the AESS through the process of erection.

3.3 ERECTION

A. Set AESS accurately in locations and to elevations indicated, and according to the AISC Code of Standard Practice.

B. In addition to the special care used to handle and erect AESS, employ the proper erection techniques to meet the requirements of the AESS Category specified:

1. AESS Erection tolerances: Erection tolerances shall meet the requirements of standard frame tolerances for structural steel per the AISC Code of Standard Practice. Note that erection tolerances in this context refers to field erection to structural steel and not to the assembly of AESS parts which are governed by section 3.6.B

2. Bolt Head Placement: All bolt heads shall be placed as indicated on the structural design document. Where not noted, the bolt heads in a given connection shall be placed to one side;

3. Removal of field connection aids: Run-out tabs, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure. Welds at run-out tabs shall be removed to match adjacent surfaces and ground smooth. Holes for erection bolts shall be plug welded and ground smooth where specified;

4. Filling of connection access holes: Filling shall be executed with proper procedures to match architectural profile, where specified;

5. Field Welding: Weld profile, quality, and finish shall be consistent with AESS Category specified and the visual samples, as applicable, approved prior to fabrication.

3.4 FIELD CONNECTIONS

A. Bolted Connections: Make in accordance with Section 05120. Provide bolt type and finish as specified and place bolt heads as indicated on the approved shop drawings.

B. Welded Connections: Comply with AWS D1.1, AISC Code of Standard Practice, Section 05120 and this specification. Appearance and quality of welds shall be consistent with the AESS

Category specified and visual samples as applicable. Assemble and weld built-up sections by methods that will maintain alignment of members to the tolerance of this Subsection.

1. Assemble and weld built-up sections by methods that will maintain alignment of axes.

2. Verify that weld sizes, fabrication sequence, and equipment used for AESS will limit distortions to allowable tolerances.

3. Tolerances for AESS work are specified in section 3.6B of this specification.

C. Field connections shall meet the same requirements as those required in section 2.5.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance with manufacturer's instructions, subject the visual acceptance requirements of section 2.7.

B. The application of filler must be done in accordance with Section 2.4.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

3.6 SCOPE AND REQUIREMENTS

A. General Requirements. When members are specifically designated as "Architecturally Exposed Structural Steel" or "AESS" in the Contract Documents, the requirements in Table 1 (page 16) of this specification shall apply. AESS members or components shall be fabricated and erected with the care and dimensional tolerances that are stipulated in the following sub-section 3.6.B.

B. Definition of Categories. Categories are listed in the AESS Matrix shown in Table 1 (page 16) where each Category is represented by a set of Characteristics. The following Categories shall be used when referring to AESS:

AESS 1: Basic Elements
Suitable for "basic" elements which require enhanced workmanship.

AESS 2: Feature Elements viewed at a Distance > 20 ft.
Suitable for "feature" elements viewed at a distance greater than twenty feet. The process involves basically good fabrication practices with enhanced treatment of weld, connection and fabrication detail, tolerances for gaps, copes. Tolerances of fabricated forms are more stringent – generally ½ of standard tolerance

AESS 3: Feature Elements viewed at a Distance ≤ 20 ft.
Suitable for "feature" elements – where the designer is comfortable allowing the viewer to see the art of metalworking – welds are generally smooth but visible, some grind marks are acceptable. Tolerances of fabricated forms are more stringent –

generally 1/3 of standard tolerance. The structure is normally viewed closer than twenty feet and is frequently subject to touch by the public.

AESS 4: Showcase Elements.
Suitable for "showcase or dominant" elements – used where the designer intends that the Form is the only feature showing in an element. All welds are ground and filled edges are ground square and true. All surfaces are sanded/filled. Tolerances of fabricated forms are more stringent – generally 1/4 of standard tolerance. All surfaces to be "glove" smooth.

AESS C: Custom Elements.
Suitable for elements who require a different set of Characteristics as specified in Category 1, 2, 3 or 4.

C. Additional Information. The following additional information shall be provided in the Contract Documents when AESS is specified:

1. Specific identification of members or components that are AESS using the AESS Categories listed in 1.1.2. Refer to Table 1;

2. Fabrication and/or erection tolerances that are to be more restrictive than provided for in this specification.

3. For Categories AESS 2, 3, 4 requirements, if any, of a visual sample or first-off component for inspection and acceptance standards prior to the start of fabrication;

4. For Category AESS C, the AESS Matrix included in Table 1 shall be used to specify the required treatment of the element.

D. Additional Definitions. For the purposes of this specification, the following definitions apply:

1. Camber – A curve of single curvature about the strong axis of a member, regardless of the orientation of that member. Camber shall be measured as the

maximum offset from a theoretical straight line drawn between the ends of the member.

2. Sweep – A curve of single curvature about the weak axis of a member, regardless of the orientation of that member. Sweep shall be measured as the maximum offset from a theoretical straight line drawn between the ends of the member.

3. Exposed to View – Part of the structure (i.e. weld, seam, etc.) shall be considered "exposed to view" if the size of the item subtends an angle greater than or equal to 1 arcminute (1°/60) when view at "Normal viewing distances"

4. Exposed - Part of the structure (i.e. weld, seam, etc.) shall be considered "exposed" if the size of the item subtends an angle less than 1 arcminute (1°/60) when viewed at "Normal viewing distances" A part of the structure which is exposed is any part of the structure (i.e. weld, seam, etc.) which while on a surface which can be readily seen, the part of the structure (i.e. weld, seam, etc.) is not discernible from normal viewing distances.

5. Normal Viewing Distance – The distance from which a structure or part of structure will be view under typical installed conditions. For the purposes of this specification, Normal Viewing Distance shall be defined by the Commissioner prior to the start of fabrication.

3.7 SHOP DETAIL, ARRANGEMENT AND ERECTION DRAWINGS

A. Identification. All members designated as AESS members are to be clearly identified to a Category, either AESS 1, 2, 3, 4 or C, on all shop detail, arrangement and erection drawings.

B. Variations. Any variations from the AESS Categories listed must be clearly noted. These variations could include machined surfaces, locally abraded surfaces, and forgings. In addition:

1. If distinction is to be made between different surfaces or parts of members the transition line/plane must be clearly identified/defined on the Shop detail, arrangement and erection drawings;

2. Tack welds, temporary braces, fixtures used in fabrication are to be indicated on shop drawings;

3. All architecturally sensitive connection details will be submitted for approval by the Commissioner prior to completion of shop detail drawings.

3.8 FABRICATION

A. General Fabrication. The fabricator is to take special care in handling the steel to avoid marking or distorting the steel members.

1. Care is also taken to minimized damage to any shop paint or coating.

2. If temporary braces or fixtures are required during fabrication, during shipment, or to facilitate erection, care must be taken to avoid and/or repair any blemishes or unsightly surfaces resulting from the use or removal of such temporary elements.

3. Tack welds are ground smooth.

4. Members which exhibit reverse and or double curvature (or more) are unacceptable under any and all circumstances unless the member is specially detailed as such. The member shall be replaced at no expense to the City of New York or result in any financial liability of the commissioner, architect and engineer.

5. All slings will be nylon type or chains with softeners or wire rope with softeners.

B. Unfinished, Reused or Weathering Steel. Members fabricated of unfinished, reused or weathering steel that are to be AESS may still have erection marks, painted marks or other marks on surfaces in the completed structure. Special requirements shall be specified as Category AESS C.

C. Tolerances for Rolled Shapes. The permissible tolerances for depth, width, and out of square, camber and sweep of rolled shapes shall be as specified in ASTM A6. The following exceptions apply:

1. For Categories AESS 3 and 4 and otherwise specified in the Contract Documents: The matching of abutting cross-sections shall be required;

2. For Categories AESS 2, 3 and 4: The as-fabricated straightness tolerance of a member as follows:
    1. AESS 2 – one half the standard sweep and camber tolerance in ASTM A6
    2. AESS 3 – one third the standard sweep and camber tolerance in ASTM A6
    3. AESS 4 – one quarter the standard sweep and camber tolerance in ASTM A6
    4. AESS C – As specified in the contract documents. If no tolerance is specified, the fabricator must request information prior to bidding. The City of New York, the Commissioner and the design team are not liable for any cost overruns associated with the fabricator assuming the incorrect tolerance criteria.

3. For members with flanges less than 3-inches wide the camber and sweep tolerances shall be the same as the sweep tolerances for members whose flange is greater than 3 inches unless otherwise specified in the contract documents.

4. Any deviations of from these tolerances must be agreed to by the Commissioner and the contractor prior to the commencement of work. If the tolerances are reduced from what is specified for technical reasons, the fabricator shall provide a credit to the City of New York since there is a reduction in the technical requirements for the fabricator. The fabricator cannot assume a reduction

tolerance from what is specified prior to the negotiation of the reduction of tolerances. The City of New York, the Commissioner and the architect and engineer are not liable for any costs associated with assumptions on the part of the contractor which are not clear spelled out on the contract documents.

D. Tolerances for Built-up Members. The tolerance on overall profile dimensions of members made up from a series of plates, bars and shapes by welding is limited to the accumulation of permissible tolerances of the component parts as provided by AWS D1.1. For Categories AESS 2, 3 and 4, the as-fabricated straightness tolerance for the member are as follows:

1. For Categories AESS 2, 3 and 4: The as-fabricated straightness tolerance of a member as follows:
   a) AESS 2 – one half the standard sweep and camber tolerance in AWS D1.1
   b) AESS 3 – one third the standard sweep and camber tolerance in AWS D1.1
   c) AESS 4 – one quarter the standard sweep and camber tolerance in AWS D1.1
   d) AESS C – As specified in the contract documents. If no tolerance is specified, the fabricator must request information prior to bidding. The City of New York, the Commissioner and the design team are not liable for any cost overruns associated with the fabricator assuming the incorrect tolerance criteria.

2. Any deviations of from these tolerances must be agreed to by the Commissioner and the contractor prior to the commencement of work. If the tolerances are reduced from what is specified for technical reasons, the fabricator shall provide a credit to the City of New York since there is a reduction in the technical requirements for the fabricator. The fabricator cannot assume a reduction tolerance from what is specified prior to the negotiations of the reduction of tolerances. The City of New York, the Commissioner, the architect and engineer are not liable for any costs associated with assumptions on the part of the contractor which are not clear spelled out on the contract documents.

E. Joints. For Categories AESS 3 and 4, all copes, miters and butt cuts in surfaces exposed to view are made with uniform gaps, if shown to be open joint, or in uniform contact if shown without gap.

F. Surface Appearance. For Categories AESS 1, 2 and 3, the quality surface as delivered by the mills should be acceptable. For Category AESS 4, the steel surface imperfections should be filled and sanded.

G. Welds. For corrosive environments, all joints should be seal welded. In addition:

1. For Categories AESS 1, 2 and 3, a smooth uniform weld will be acceptable.

2. For Category AESS 4, the weld will be contoured and blended to NOMMA

3. For Categories AESS 1, 2, 3 and 4, all weld spatter is to be avoided/removed where exposed to view.

4. For Categories AESS 1 and 2, weld projection up to 2 mm is acceptable for butt and plug welded joints. For Categories AESS 3 and 4, welds will be ground smooth/filled.

H. Weld Show-through. It is recognized that the degree of weld show-through, which is any visual indication of the presence of a weld or welds on the opposite surface from the viewer, is a function of weld size and material thickness.

1. For Categories AESS 1, 2 and 3, the members or components will be acceptable as produced.

2. For Category AESS 4, the fabricator shall avoid the weld show-through.

I. Surface Preparation for Painting. Unless otherwise specified in the Contract Documents, the Fabricator will clean AESS members to meet the requirement of SSPC-SP 6 "Commercial Blast Cleaning" (sandblast or shotblast). Prior to blast cleaning:

1. Any deposits of grease or oil are to be removed by solvent cleaning, SSPC-SP 1;

2. Weld spatter, slivers, surface discontinuities are to be removed;

3. Sharp edges resulting from flame cutting, grinding and especially shearing are to be softened.

J. Hollow Structural Sections (HSS) Seams.

1. For Categories AESS 1 and 2, seams of hollow structural sections shall be acceptable as produced.

2. For Category AESS 3, seams shall be oriented away from view or as indicated in the Contract Documents.

3. For Category AESS 4, seams shall be treated so they are not apparent.

4. 1/16" Maximum Radius Corners

3.9 DELIVERY OF MATERIALS

A. General Delivery. The Fabricator shall use special care to avoid bending, twisting or otherwise distorting the Structural Steel. All tie downs on loads will be either nylon strap or chains with softeners to avoid damage to edges and surfaces of members.

B. Standard of Acceptance. The standard for acceptance of delivered and erected members shall be equivalent to the standard employed at fabrication.

3.10 ERECTION

A. General Erection. The Erector shall use special care in unloading, handling and erecting the AESS to avoid marking or distorting the AESS. The Erector must plan and execute all operations in such a manner that allows the architectural appearance of the structure to be maintained.

1. All slings will be nylon strap or chains with softeners.

2. Care shall be taken to avoid damage to any shop paint or coating.

3. If temporary braces or fixtures are required to facilitate erection, care must be taken to avoid and/or repair any blemishes or unsightly surfaces resulting from the use or removal of such temporary elements.

4. Tack welds shall be ground smooth and holes shall be filled with weld metal or body filler and smoothed by grinding or filling to the standards applicable to the shop fabrication of the materials.

5. All backing bars will be removed and ground smooth.

6. All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another.

B. Erection Tolerances. Unless otherwise specified in the Contract Documents, members and components are plumbed, leveled and aligned to a tolerance equal to the tolerance permitted for structural steel and AESS

C. Adjustable Connections. Specifically designated more stringent erection tolerances for AESS require that the City of New York's plans specify/allow adjustable connections between AESS adjoining structural elements, in order to provide the Erector with means for adjustment and/or specify the method to be used to achieve the desired dimensions. Any proposed adjustment details desired by the Erector shall be submitted to the Commissioner, Architect and Engineer for review.

Table 1 – AESS Category Matrix

Id	Characteristics	AESS C *Custom Elements*	AESS 4 *Showcase Elements* Viewed at a Distance ≤ 1 ft.	AESS 3 *Feature Elements* Viewed at a Distance ≤ 20 ft.	AESS 2 *Feature Elements* Viewed at a Distance > 20 ft.	AESS 1 *Basic Elements*	SSS *Standard Structural Steel* AISC
				√	√	√	
1.1	Surface preparation to SSPC-SP 6 or higher		√				
1.2	Sharp edges ground smooth		√	√	√	√	
1.3	Continuous weld appearance		√	√	√	√	
1.4	Standard structural bolts		√	√	√	√	
1.5	Weld spatters removed		√	√	√	√	
			√	optional	optional		
2.1	Visual Samples		√	√	√		
2.2	Stricter fabrication tolerances – list tolerances		√	√	√		
2.3	Fabrication marks not apparent		√	√	√		
2.4	Welds uniform and smooth		√	√			
3.1	Mill marks removed		√	√			
3.2	Butt and plug welds ground smooth and filled		√	√			
3.3	HSS weld seam oriented for reduced visibility		√	√			
3.4	Cross sectional abutting surface aligned		√	√			
3.5	Joint gap tolerances minimized		√	optional			
3.6	All welded connections		√				
4.1	HSS seam not apparent		√				
4.2	Welds contoured and blended		√				
4.3	Surfaces filled and sanded		√				
4.4	Weld show-through minimized		√				
C.1	_____						
C.2	_____						

Table 1 – AESS Category Matrix (cont'd)

Notes

1.1 Prior to blast cleaning, any deposits of grease or oil are to be removed using steam or hot water in conjunction with tri-sodium phosphate or similar cleaning agent.

1.2 Rough surfaces are to be deburred and ground smooth. Edges must be prepared so that they are consistent with the design intent of the structure.

1.3 Intermittent welds are made continuous, either with additional welding, caulking or body filler. For corrosive environments, all joints should be seal welded. Seams of hollow structural sections shall be acceptable as produced.

1.4 All bolt heads in connections shall be on the same side, as specified, and consistent from one connection to another. Whenever possible use smaller than usual bolts, flatheads, studs, pins, cogs and slots, all achieved with tight cutting / drilling tolerances and high-strength bolts

1.5 Weld spatter, slivers, surface discontinuities are to be prevented from accumulating with spatter shields or sprays. Weld projection up to 2 mm is acceptable for butt and plug welded joints.

2.1 Visual samples are either a 3-D rendering, a physical sample, a first off inspection, a scaled mock-up or a full-scale mock-up, as specified in Contract Documents.

2.2 These tolerances are required to be stricter than those of standard structural steel as specified in ASTM A6 or AWS D1.1

2.3 Members marked with specific numbers ("piece marks") during the fabrication and erection processes are not to be visible.

3.1 All mill marks are not to be visible in the finished product.

3.2 Limited caulking or body filler is acceptable provided filler is not visible and does not affect performance of structure or finish coatings.

3.3 Seams shall be oriented away from view or as indicated in the Contract Documents.

3.4 The matching of abutting cross-sections shall be required.

3.5 This characteristic is similar to 2.2 above. A clear distance between abutting members of 3 mm is required.

3.6 Hidden bolts may be considered.

4.1 HSS seams shall be treated so they are not apparent.

4.2 In addition to a contoured and blended appearance, welded transitions between members are also required to be contoured and blended.

4.3 The steel surface imperfections should be filled and sanded.

4.4 The back face of the welded element caused by the welding process can be minimized by hand grinding the backside of the weld. The degree of weld-through is a function of weld size and material.

Additional characteristics may be added for custom elements.

END OF SECTION 051213

This Page Intentionally Left Blank

SECTION 051250 – NETTING BARRIER SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Related work specified elsewhere:

1. DDC General Conditions
2. Division 3 Section "Cast-in-Place Concrete"
3. Division 5 Section "Architectural Exposed Structural Steel"
4. Division 9 Section "Painting and Finishing"

1.2 SUMMARY

A. Steel Masts

1. The heights and locations of all steel masts are shown on the Contract Drawings.
2. This specification is performance based, and final engineering responsibility rests with the contractor.

B. Barrier Netting

1. Barrier netting details are for bidding purposes only, the final determination for the sizes, location, and layout of the cables supporting the barrier netting will be the responsibility of the Contractor.
2. The Contractor shall install a rigid barrier along the ground. There are to be no openings or gaps between the bottom of the netting and the finished grade. Determination of the rigid barrier is to be made by the Contractor and approved by the Commissioner.
3. This specification is performance based. The contractor shall engineer, fabricate and install the netting barrier as shown on the drawings and specification herein.

C. Site Lighting

1. Coordinate manufacture and installation of site lighting as they pertain to the netting poles.

1.3 REFERENCE STANDARDS

A. New York City Building Code, 1968.

B. Steel Construction Manual, American Institute of Steel Construction (AISC), latest edition.

C. American Society of Testing and Materials (ASTM) standards, latest edition.

D. Standard Welding Symbols- A2.0 – American Welding Society (AWS).

E. Specification for Mild Steel Covered Arc – Welding Electrodes – A5.5 – AWS.

F. Specification for Low Alloy Steel Covered Arc – Welding Electrodes – A5.5 – AWS.

G. Structural Welding Code – D1.1 – AWS.

H. Code of Standard Practice for Steel Buildings and Bridges – AISC.

I. Minimum Design Loads for Buildings and Other Structures- ASCE 7-05.

J. Shop, Field, and Maintenance Painting of Steel- SSPC-PA 1 - The Society for Protective Coatings (SSPC).

1.4 LEED PERFORMANCE REQUIREMENTS

A. The project's environmental performance goals include achieving minimum LEED-NC v2.2 Silver certification for the work done within LEED boundary including,

1. Gabion Walls

2. Netting Poles

B. Specific project goals that may impact this area of work include:

1. Use of materials with recycled-content

2. High-albedo paving materials

3. High-albedo roof materials

4. Construction waste management

5. Site soil erosion and sedimentation control

C. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the stated LEED PERFORMANCE REQUIREMENTS section.

D. Products used in this section shall contain recycled content, as available.

E. Products fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the LEED Certification Requirements Section.

1.5 WORK TO BE PROVIDED

A. Furnish all materials, equipment, labor, supplies, and load tests required for the installation of steel masts and netting as specified herein and as shown on the Contract Drawings.

B. Foundations for steel masts should be designed for mast locations where site conditions do not preclude standard pole specifications. The elevation of the footing for the mast will need to be located below adjacent structures or walls as specified on the Contract Drawings

C. No fabrication may begin until full shop drawings are made, submitted, and approved for the complete package.

D. Calculations are required for proposed alternatives signed and sealed by a Professional Engineer licensed in the State of New York for review by the Commissioner.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural requirements:

1. Steel masts and steel connections shall be designed to maximum stresses for fatigue set out in AISC.
2. Loads, including wind and seismic, are to be determined from the New York City Building Code.
3. Basic wind speed= 105 mph.
4. Refer to the project Geotechnical report for soil conditions.
5. Reactions of masts to foundations are to be provided at locations within 20 feet of any below-grade structure.
6. The masts should be designed as having a Category III Importance Factor and a design life of 100 years.
7. Deflections for the steel masts should be within acceptable design practice.
8. The masts shall be designed for the most critical of the following conditions:
   a. 112 mph wind for a 100-year storm.
   b. 80 mph wind for a 10-year storm.
   c. 3/8" ice accumulating on the masts and netting concurrent with a 50 mph wind and a solid area of 25%.
   d. Additional load cases deemed appropriate by the Contractor.

B. Other performance requirements

1. The netting, cables, and ground barrier shall be designed as having a Category I Importance Factor and a design life of a minimum of 8 years.
2. Pole manufacturer to provide appropriate systems required for the installation and functioning of site lighting as indicated on the Contract Drawings.

1.7 SUBMITTALS

A. Welders: Before assigning any welder to work covered by this Section of the specification, the Contractor shall provide the Engineer with certification that each of these welders has passed qualification tests and is certified using AWS procedures. The certifications shall state that the operator shall have been performing satisfactory welding of the required type within the three-month period previous to the subject work. A certification shall be submitted for each welding operator stating the name of the operator, the name and title of the person conducting the examination, the bend of specimens, the position of welds, the results of tests, and the date of examination. If required by the Engineer, the Contractor shall submit identifying stenciled test coupons actually made by any operator whose workmanship is subject to question. The Contractor shall require any welder to retake the test when, in the opinion of the Engineer, the work of the welder created a reasonable doubt as to the proficiency of the welder. Tests, when required, shall be conducted at no additional expense to the City of New York. Re-certification of the welder shall be made to the Engineer only after the welder has taken and passes the required re-test. Welder qualifications must be considered current per AWS specifications. The Engineer may require coupons to be cut from any location in any joint for testing. All sections of welds found defective shall be chipped or cut out to base metal and re-welded properly before proceeding with the work. Should any two coupons cut from the work of any welder show strengths, under test, less than that of base metal, it will be considered evidence of negligence or incompetence and such welder shall be permanently removed from any part of a structure. The members cut shall be repaired at no additional cost to the City of New York, in a neat and workmanlike manner with joints of proper type to develop the full strength of the members in joints cut, with peening as necessary to relieve residual stress.

B. The Contractor shall submit drawings and typewritten procedures describing the exact sequence of mast installation. All masts shall be numbered. No work shall commence until procedures are approved. A plan must be submitted showing the designation of all masts by an identifying system. Six (6) copies each of the approved type of mast and identification plan shall be submitted to the Commissioner for record purposes and review. One (1) copy each of the approved type of mast and identification plan shall be submitted to the Engineer of Record and one (1) copy each to the Architect.

C. The Contractor shall submit for review any and all design calculations and structural analysis associated with design alternatives. All design related submissions must be signed and sealed by a Professional Engineer licensed in the State of New York.

D. The Contractor shall prepare and submit to the Engineer for review and approval Shop Drawings and a design submission describing the netting barrier system or systems intended for use. The Shop Drawings and design submission shall be submitted thirty (30) working days prior to the commencement of mast or foundation work. The Working Drawing and design submission shall include the following:

1. A foundation schedule giving:
   a. Location and identification for all piles, rock anchors, and pile caps;
   b. Design loads for all foundations;
   c. Size and minimum embedment of all rock anchors;

d. Size of all piles;
e. Dimensions of all pile caps or mast foundations.

2. A mast schedule giving:
   a. Location and identification for all steel masts;
   b. Steel dimensions for all masts.
3. A drawing of the typical foundation(s) including the following details:
   a. Rock anchors with size, embedment depth, and corrosion protection details;
   b. Size and depth of piles with accompanying corrosion protection details;
   c. Dimensions of pile cap or mast foundation.
4. A drawing in elevation for a typical steel mast including:
   a. Dimensions at various sections along mast;
   b. Height and degree of taper;
   c. Type of corrosion protection for steel.
5. Certificates of Compliance for the following materials, if used (The certificate shall state that the material or assemblies to be provided will fully comply with the requirements of the contract.):
   a. Steel sections;
   b. Portland cement;
   c. Corrosion protection system (sub- and above-grade);
   d. Steel bars.
6. An overall construction schedule.
7. Shop Drawings and design submissions are to be signed and sealed by a Professional Engineer licensed in the State of New York.

E. The Engineer shall approve or reject the Contractor's Working Drawings and design submission within thirty (30) working days after receipt of the submission. Approval of the design submittal does not relieve the Contractor of his responsibility for the successful completion of the work.

F. LEED SUBMITTALS REQUIREMENTS

1. For all installed products and materials of this Section which are within the LEED boundary, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

G. SAMPLES

1. Contractor to provide a 4-ft by 4-ft samples of the golf netting for approval by the Commissioner.

1.8 QUALITY ASSURANCE

A. Qualifications

1. The Contractor shall have at least three (3) years of experience in golf barrier installations or at least three (3) years of experience in installations similar to the work specified herein. Similar projects include the installation of radio masts, transmission towers, electric towers, ski lift towers, or additional installations as approved by the Commissioner.

B. Regulatory Requirements

1. Building Code: Work of this section shall conform to all requirements of the NYC Building Code and all applicable regulations of governmental authorities having jurisdiction, including safety, health, noise, and anti-pollution regulations. Where more severe requirements than those contained in the building code are given in this section, the requirements of this section shall govern.
2. New York City Board of Standards and Appeals (BS) approvals, or
3. NYC materials and equipment acceptance (MEA) approvals.
4. New York City Department of Environmental Protection.
5. New York City Department of Parks and Recreation.

C. Certifications

1. Structural steel shall conform to the material acceptance, certification, and inspection requirements of Article 7, Chapter 1 – Subchapter 1 and Tables 10-1 and 10-2 of the Building Code (Title 27).
2. Quality welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1.9 CONSTRUCTION QUALITY ASSURANCE

A. The Construction Quality Assurance (CQA) Inspector will monitor all aspects of the construction of mast foundations and steel masts. The CQA Inspector will be the on-site representative of the City of New York and will hand over all reports to the City of

New York at the conclusion of the work being performed. The CQA Inspector will perform material conformance testing as required and ensure visual acceptance in the masts. The Contractor shall be aware of the activities required by the CQA Inspector and shall account for these activities in the construction schedule. The Contractor shall correct all deficiencies and nonconformities identified by the CQA Inspector at no additional cost to the City of New York.

1.10 MAINTENANCE MANUAL

A. A maintenance manual must be developed and submitted by the Contractor to the City of New York no later than one month after the completion of installation. The manual must address:

1. Net maintenance and servicing
2. Net and cable replacement schedule
3. Pole painting and general servicing
4. All other maintenance issues

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site at such intervals as to ensure uninterrupted progress of work.

B. Store materials to permit easy access for inspection and identification.

C. Protect materials from the elements and from other damage at the site. Replace and pay for material and work damaged and rejected by the City of New York or Engineer.

1.12 SITE CONDITIONS

A. Borings are furnished for information only. Conditions shown cannot be warranted or assumed to be uniform throughout the project.

B. Contractor shall visit the site and be thoroughly familiar with all existing conditions.

C. Take field measurements as required by drawings. Where possible, take field measurements of existing conditions prior to fabrication. Verify that field measurements are same as those shown on the drawings and shop drawings. Report all deviations to the Engineer of Record and the Construction Manager in writing.

D. The Water Treatment Plant is to remain operational during the installation of the netting barrier. The Contractor must ensure to take all precautions and planning necessary to avoid affecting the operation of the Plant. A detailed schedule of the each day's activities must be given to the City of New York before the conclusion of the previous work day.

1.13 WARRANTY

A. Netting and Cables: Provide a minimum five (5) year warranty.

B. Steel masts: Provide a minimum ten (10) year warranty.

C. Additional warranty requirements may be required by New York City. - PART

PART 2 PRODUCTS

2.1 FOUNDATIONS

A. For foundation specifications including information relating to piles and rock anchors, refer to Section 03300 Cast-in-Place Concrete.

2.2 STEEL MAST

A. NP-01: Netting Poles

B. Netting pole shall be fabricated from High Strength Low Alloy (HSLA) steel or carbon steel having a minimum yield strength (f_y) of 65,000 psi and a ratio of yield strength to ultimate strength less then or equal to 0.85 and a chemistry and heat treatment conducive to site welding. Steel will conform to an accepted national standard of at least one of the following organizations:

1. American Society of Testing and Materials (ASTM).
2. American Petroleum Institute (API).
3. American Iron and Steel Institute (AISI).
4. Society of Automotive Engineers (SAE).
5. Military Standards issued by the United States Department of Defense.

C. Steel masts shall be coated to match existing DEP netting poles.

D. Painted color of masts: To match Package 3 netting poles.

E. Steel components for the masts shall be erected with a fabrication tolerance of +/-1/32".

F. Steel masts shall be erected within an erection tolerance of .002 (1/500) of the mast height.

2.3 NETTING

A. NB-01: Netting Barrier

B. Netting should be Redden #930 polyester mesh or approved similar. Golf range netting shall have a minimum 104.5-lb. single mesh breaking strength; 1" mesh

size. Mesh breaking strength as determined per ISO 1806. Netting to withstand 105-mph winds.

1. Color: Black

C. Determination of cable size, type, and layout should be made by the Contractor to provide for net deflections within appropriate limits. Cables shall be woven into the netting.

D. Netting to be clipped to the cable at a minimum of 3' spacing using galvanized hooks.

E. Netting to have an anticipated service life of ten (10) years minimum between replacements.

F. Contractor shall provide and install all miscellaneous hardware required for the installation of the netting. This should included but is not limited to the following:

1. Turnbuckles
2. Clips
3. Eye Bolts
4. Steel Track
5. Pulleys
6. Stainless Steel Cable

G. All miscellaneous hardware to be hot dipped galvanized with the following exceptions:

1. Stainless Steel Cable
2. Any items noted on the drawings as stainless steel or another material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine all adjoining work on which this work is in any way dependent for proper installation and workmanship. Report to the City of New York any conditions which prevent the performance of the work. Due not allow mast installation to proceed until unsatisfactory conditions have been corrected.

B. Anchor bolts: The contractor shall ascertain by accurate survey the existing location, alignment, and elevation of the anchor bolts embedded in the concrete by others prior to (at least 21 working days) the start of the structural steel erection. He shall immediately bring to the attention of the Commissioner any discrepancy observed between the Contract Documents and the as-built conditions. Steel erection shall not start until corrective measures, if required, have been performed.

3.2 PREPARATION

A. Pre-Installation/Coordination Meeting: Before commencing construction conduct a conference at Project site.

1. Meet with representatives of the Water Treatment Plant Design Team and Construction Manager, Commissioner, Architect, Engineer of Record, representatives of the NYC Department of Environmental Protection and the Department of Parks and Recreation.
2. Review materials, methods, procedures and tolerances of materials.
3. Review schedule and work plan and coordination with other work and operation of Plant.
4. Review governing regulations, inspection and testing if applicable.
5. Review of Installation Procedure as prepared by the Contractor.
6. Review temporary protection requirements.
7. Document proceedings and furnish copy of record to each participant within two (2) weeks.

3.3 FOUNDATION INSTALLATION

A. For foundation specifications Section 03300.

3.4 MAST INSTALLATION

A. Equipment used for foundation installation and mast erection shall have access to areas as laid out by the City of New York and Construction Manager.

B. Installation procedure of the mast and netting is to be determined by the Contractor and laid out in detail at the Pre-Installation/Coordination Meeting. A staging area will be provided to allow for enough space for the mast components to be assembled at the site before installation.

C. Welds at joints to be finished to provide for flush surface.

D. First mast to be installed and approved by the CQA Inspector before installation of subsequent masts.

E. Strength of masts shall be tested and approved by the CQA Inspector before the installation of netting may proceed.

F. Netting installation is not to proceed on a day with heavy winds or other adverse weather conditions.

G. Site joints to be welded, ground smooth to provide flush surface. Where flush butt welds, plug welds and puddle welds are required, make welds slightly oversized and grind flush with adjacent surfaces and flat. Dress welds smooth, uniform and consistent, and otherwise treat as required matching and blending with adjoining surfaces of parent steel.

3.5 SPECIAL INSPECTIONS

A. Special inspections as required by the NYC Building Code will be performed by an approved special inspection agency.

B. The Contractor shall give the special inspection agency and the Testing Agency at least 7 days notice prior to commencing work on the project. Once project is underway, contractor shall notify each party at least 48 hours in advance of all work subject to their inspection.

C. The Contractor shall furnish all access, labor, and equipment as required by the Special Inspection Agency or Testing Agency to perform their duties.

END OF SECTION 051250

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 053100 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following:
   1. Roof deck
   2. Composite floor deck
   3. Conform floor deck

B. Related Sections include the following:
   1. Section 018113 –Sustainable Requirements
   2. Section 051200 – Structural Steel
   3. Section 071326 – Sheet Membrane Waterproofing
   4. Section 071413 – Fluid Membrane Waterproofing

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   1. Include statement indicating costs for each product having recycled content.

C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

D. Product Certificates: For each type of steel deck, signed by product manufacturer.

E. Welding certificates.

F. Field quality-control test and inspection reports.

G. Research/Evaluation Reports: For steel deck.

1.4 SUSTAINABLE DESIGN LEED QUALITY CRITERIA AND SUBMITTAL REQUIREMENTS

A. Refer to Division 1 Section 018113 – Sustainable Requirements – LEED 2009

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Certificates for Credit MR 5: For products and materials that comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. Laboratory Test Reports for Credit EQ 4.2: For paints provide documentation indicating that products comply with the testing and product requirements with VOC content and chemical component limit not exceeding limits of Green Seals Standard GS-11 requirements. Provide anti-corrosive coatings with VOC content limits not exceeding limits of Green Seals Standard GS03. For interior paints and coatings not already covered by GS 11 and GS 03, insure VOC content of primers, under coatings, sealers, and clear wood finishes used are less than current VOC content limits of SCAQMD Rule #1113.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. Codes and Standards: Meet requirements of following, except to extent of most stringent requirements of Contract Documents and of codes and regulations of public authorities bearing on performance of the work:
1. AISI "Specification for the Design of Cold-Formed Steel Structural Members."
2. SDI "Specifications and Commentary for Composite Steel Floor Deck."
3. SDI "Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Deck Floor Systems with Electrical Distribution."
4. SDI "Diaphragm Design Manual," Second Edition.
5. AWS D1.1 "Structural Welding Code - Steel."
6. AWS D1.3 "Structural Welding Code - Sheet Metal."
7. AWS A2.4 "Symbols for Welding, Brazing, and Non-Destructive Examination

E. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:
   1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G90 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Deck Profile: As indicated.
   3. Profile Depth: As indicated.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Span Condition: As indicated.
   6. Side Laps: Overlapped.

2.2 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
   1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60zinc coating.
   2. Profile Depth: As indicated.
   3. Design Uncoated-Steel Thickness: As indicated.
   4. Span Condition: As indicated.

2.3 NONCOMPOSITE FORM DECK

A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
   1. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 minimum.
   2. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   3. Color: Manufacturer's standard.

B. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade40 G60 zinc coating.
   1. Profile Depth: 1-1/2 inches.
   2. Design Uncoated-Steel Thickness: 0.0474 inch
   3. Span Condition: As indicated or Triple span or more.
   4. Side Laps: Overlapped or Interlocking seam

C. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of five welds per 36" deck unit at each support.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 12 inches, and as follows:
   1. Fasten with a minimum of 1-1/2-inch- long fillet welds or 5/8" puddle welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints lapped 2 inches minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart or as indicated on the drawings, whichever is the greater number of welds.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 18 inches, and fasten with a minimum of 1-1/2-inch- long fillet welds or 5/8" puddle welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with lapped end joints as follows:

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: City of New York will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports for Special Inspection.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor, Architect and Commissioner.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Hole Patching: Patch holes in steel deck units resulting from welding process. Patch material shall be same metal, profile and protective coating as deck unit. Install patch to bottom side of deck; weld in place and meet applicable requirements of this Section.

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9 Section " Painting and Finishing"

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

This Page Intentionally Left Blank

SECTION 054000

COLD FORMED METAL FRAMING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the cold formed metal framing as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. "C" shaped steel studs for exterior non-load bearing wall frame construction.
2. "C" shaped steel joists.
3. Anchors and accessories.
4. Field inspection.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Structural steel - Section 051200.

C. Building insulation - Section 072100.

D. Vapor permeable air barrier - Section 072700.

E. Interior steel stud construction - Section 092900.

F. Gypsum sheathing and cement board back-up sheathing - Section 092900.

1.4 QUALITY ASSURANCE

A. Component Design: Compute structural properties of studs in accordance with AISI "North American Specification for the Design of Cold Formed Steel Structural Members."

B. Fire-Rated Assemblies: Where framing units are indicated to be components of fire-resistance rated assemblies, provide cold formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspection

agency acceptable to authorities having jurisdiction. Products used in the assembly shall carry a classification label from an approved testing and inspection agency.

C. Qualifications

1. Manufacturer's Qualifications: Minimum three years' experience in producing products of the type specified.

2. Installer's Qualifications: Minimum three years' experience in installation of the type of product specified.

3. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M "Structural Welding Code - Steel" and AWS DL3 "Structural Welding Code – Sheet Steel."

D. Pre-Installation Meeting

1. Convene meeting at project site within one week of scheduled start of installation with representatives of the following in attendance: City of New York, Commissioner, General Contractor, and metal framing subcontractor.

2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.

3. Keep minutes of meeting, including responsibilities of various parties and deviations from specifications and installation instructions. Distribute minutes to attendees within 72 hours.

E. Comply with the following standards:

1. American Iron an Steel Institute (AISI):

   a. "North American Specification for the Design of Cold-Formed Steel Structural Members," latest edition.
   b. "Standard for Cold-Formed Steel Framing General Provisions."

2. American Welding Society (AWS):

   a. Structural Welding Code (D1.1).
   b. Specifications for Welding Sheet Steel in Structures (E1.3).

3. ASTM:

   a. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coted (Galvannealed) by the Hot-Dip Process.
   b. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   c. ASTM A 924 - Standard Requirements for Sheet Steel, Metallic-Coated by the Hot-Dipped Process.

d. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Non-Metallic-Coated for Cold-Formed Framing Members.
e. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
f. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
g. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

1.5 SUBMITTALS

A. Product Data: For information only, submit copies of manufacturer's product information and installation instructions for each item of cold-formed framing and accessories.

B. Shop Drawings

1. Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Indicate supplemental bracing, splices, window and door headers accessories and details as may be required for proper installation.

2. If the Contractor elects to prefabricate framing members into panels for erection, he shall submit shop drawings of such panels at suitable scale showing all dimensions, components, and methods of fastening and support.

C. For fasteners, submit product data sheet and samples.

D. Engineering Data

1. Submit Engineering Data drawings to the Commissioner for review. The Contractor is responsible for the structural design and supports for the cold-formed metal frame, and must show his proposed system and how the Performance Criteria noted below is accommodated on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

E. Quality Assurance Submittals: Submit the following:

1. Qualifications: Proof of manufacturer, installer, and welder qualifications.

2. Structural design calculations.

3. Certificates

a. Submit mill certificates signed by framing member/accessory manufacturer certifying compliance with material requirements.
b. Welder certificates.

4. Manufacturer's installation instructions for framing members and framing accessories.

F. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 PERFORMANCE CRITERIA

A. Cold-formed metal framing system shall be designed, fabricated, and installed to withstand a 30 psf suction and pressure load (or greater if required by Code) with a maximum deflection of L/720 with brick.

B. Design system to accommodate vertical deflection of structural building frame, live loading, seasonal and day/night temperature ranges and construction tolerances.

C. In New York City, comply with Local Law 17-95 for seismic connections and loads.

D. Comply with prevailing Code requirements for seismic connections and loads.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Cold formed metal framing required for work in this section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Cold formed metal framing materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.8 PRODUCT DELIVERY AND STORAGE

A. Protect metal framing units from rusting and damage. Deliver to one project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space or protect with suitable waterproof coverings. Conform to storage and handling requirements of AISI "Code of standard Practice."

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide cold-formed steel framing manufactured by Marino/Ware, Dale/Incor, Superior Steel Studs, Dietrich Metal Framing, Super Stud Building Products or approved equal.

2.2 METAL FRAMING: GENERAL

A. System Components: With each type of metal framing required, provide manufacturer's standard steel runners, (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners and accessories, as recommended by manufacturer for the applications indicated, as needed to provide a complete metal framing system.

2.3 MATERIALS

A. Steel Sheet for Studs and Tracks: ASTM A 1003 Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.

2. Coating: G90 galvanized coating.

B. Steel Sheet for Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.

2. Coating G90 galvanized coating.

2.4 FRAMING MEMBERS

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated punched, with stiffened flanges; thickness and grade as required by structural performance.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths compatible with studs un-punched, with un-stiffened flanges; thickness and grade as required by structural performance.

2.5 FRAMING ACCESSORIES

A. Stamp manufacturer's name on each accessory item.

B. Provide screws with accessories designated for screw attachment.

C. Connector Devices

1. Vertical Deflection Clips: VertiClip, including step bushings, as manufactured by The Steel Network Inc., Bypass Slab Slide Strut "PLS1" by Steel-Con, or FrameRite Outrigger Slide Clip by MarinoWare. Rigid attachments to structure and screw attachment to stud web using step-bushings to permit frictionless vertical movement. 68 mils minimum thickness, size as required by structural design calculations.

2. Rigid Clip Angles: StiffClip as manufactured by The Steel Network Inc., Multi-Use Secure Clip "MB" by Steel-Con, or FrameRite Rigid Clip Connector by MarinoWare, size as required by structural design calculations. Rigid attachment to structure and stud web.

D. Bridging

1. Cold Rolled Channel: 1-1/2 by 1/2 inch by 56 mil thick.

a. Bridging Clip: BridgeClip as manufactured by The Steel Network Inc. or approved equal. Provide attachment through stud punch-out clamping onto stud web and wrapping around bridging channel. Provide holes for screw attachment to stud web and channel.

2. Flat Strap: Width and thickness as required by structural design calculations. Rigid attachment to stud flange.

3. Solid Bridging: Channel shaped bridging with lipped flanges and integral formed clips. Screw attachment to stud. 33 mils minimum thickness, size as required by structural design calculations.

4. Bridging and accessories shall be hot dip zinc coated per ASTM A 153.

E. Header for Window and Door Openings: Provide "ICC ESR-1765 Pro X Header System" made by Brady Innovations LLC, or approved equal complete with all accessories including clips and accessories; finish and gauge to match studs.

2.6 FASTENERS

A. Screws: Corrosion resistant coated, self-drilling, pan or hex washer head. Provide screw type and size as required by structural design calculations.

B. Anchor Bolts and Studs: ASTM A 307, Grade A, carbon steel, with hex-head carbon steel nuts and flat steel washers. Hot-dip zinc coated in accordance with ASTM A 153. Provide bolt or stud type and size as required by structural design calculations.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

2.7 GALVANIZING TOUCH-UP

A. For touching up damaged galvanized surfaces after erection, provide galvanzing compound applied to a dry film thickness of 1.5 to 3.0 mils.

2.8 FABRICATION

A. Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting or screw fasteners, as standard with manufacturer.

C. Wire tying of framing components is not permitted.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where cold-formed metal framing is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION: GENERAL

A. Methods of construction shall be piece by piece.

B. Connections shall be accomplished with self-drilling screws or welding so that the connection meets or exceeds the design loads required at that connection.

C. Studs shall be installed seated squarely (within 1/16") against the web portion of the top and bottom tracks. Tracks shall rest on a continuous, uniform bearing surface.

D. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of loaded members is not permitted. Cutting of loaded members is not permitted unless under supervision of the Commissioner.

E. Temporary bracing shall be provided and left in place until work is permanently stabilized.

F. Bridging shall be of size and type shown on the approved shop drawings and as called for in the engineering calculations.

G. Install headers in all openings that are larger than the stud spacing in that wall. Form headers as shown on the drawings.

H. Insulation meeting the requirements of Section 072100 shall be placed in all jamb and header type conditions that will be inaccessible after their installation into the wall.

I. Provide jack studs to support each end of headers. These studs shall be securely connected to the header and must seat squarely in the lower track of the wall, and be properly attached to it.

J. If by design, a header is low in the wall, the less than full-height studs (cripples) that occur over the header shall be designed to carry all imposed loads.

K. Wall track shall not be used support any load unless specifically designed for that purpose.

L. All axially loaded members shall be aligned vertically, to allow for full transfer of the loads down to the foundation. Vertical alignment shall be maintained at floor/wall intersections or alternate provisions for load transfer may be made.

M. Holes that are field cut into steel framing members shall be within the limitation of the product and its design. Provide reinforcement where holes are cut through load bearing

members in accordance with manufacturer's recommendations and as approved by Commissioner.

N. Touch up all steel bared by welding using touch up coating specified herein.

O. Studs shall be spaced to suit the design requirements and limitations of collateral facing materials.

P. Care should be taken to allow for additional studs at intersections, corners, doors, windows, control joints, etc., and as called for in the shop drawings or design calculations.

Q. Install supplementary framing, blocking, and bracing in metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or loading resulting from item supported.

R. Provide for structure movement, expansion shall be allowed where indicated and necessary by design or code requirements.

S. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with components of stud system.

T. Install horizontal bridging in stud system, spaced (vertical distance) at not more than 48 inches on center. Fasten at each intersection.

U. Splicing of axially loaded members or floor joists shall not be permitted.

V. Wire tying of members is not permitted.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 055000

MISCELLANEOUS METALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the miscellaneous metal work as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Rough hardware.
2. Vertical steel ladders and ship's ladders.
3. Open riser steel service stairs.
4. Loose steel lintels.
5. Light steel framing and supports, not included as part of work of other trades.
6. Steel gratings and frames.
7. Steel plate covers and frames.
8. Structural steel door frames at service doors.
9. Cast thresholds.
10. Furnishing stair nosings for interior concrete stairs.
11. Steel bollards.
12. Miscellaneous steel trim, corner guards, angle guards and channels.
13. Countertop supports.
14. Steel floor access door.
15. Masonry support steel.
16. Sleeves in concrete walls and slabs.

17. Steel framing, bracing, supports, anchors, bolts, shims, fastenings, and all other supplementary parts indicated on drawings or as required to complete each item of work of this Section.

18. Prime painting, touch-up painting, galvanizing and separation of dissimilar metals for work of this Section.

19. Cutting, fitting, drilling and tapping work of this Section to accommodate work of other Sections and of concrete, masonry or other materials as required for attaching and installing work of this Section.

1.3 RELATED SECTIONS

A. Structural steel - Section 051200.

B. Steel Pipe and Tube Railings - Section 055210.

C. Painting - Section 099000.

1.4 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

C. Reference Standards: The work is subject to requirements of applicable portions of the following standards:

1. "Manual of Steel Construction," American Institute of Steel Construction.

2. AWS D1-1 "Structural Welding Code," American Welding Society.

3. SSPC SP-3 "Surface Preparation Specification No. 3, Power Tool Cleaning," Steel Structures Painting Council.

4. SSPC PA-1 "Painting Application Specification," Steel Structures Painting Council.

5. "Handbook on Bolt, Nut and Rivet Standards," Industrial Fasteners Institute.

D. Steel Materials: For steel to be hot dip-galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.

E. Engage the services of a galvanizer who has demonstrated a minimum of three (3) years' experience in the successful performance of the processes outlined in this specification in the facility where the work is to be done and who will apply the

galvanizing and coatings within the same facility as outlined herein. The Commissioner has the right to inspect and approve or reject the galvanizer/galvanizing facility.

F. The galvanizer/galvanizing facility must have an ongoing Quality Control/Quality Assurance program which has been in effect for a minimum of three years and shall provide the Commissioner with process and final inspection documentation. The galvanizer/galvanizing facility must have an on-premise testing facility capable of measuring the chemical and metallurgical composition of the galvanizing bath and pickling tanks.

G. Inspection and testing of hot-dip galvanized coating shall be done under the guidelines provided in the American Hot-Dip Galvanizers Association (AGA) publication "Inspection of Products Hot-Dip Galvanized After Fabrication."

1.5 PERFORMANCE STANDARDS

A. Stairs and railings shall be constructed to conform to the following performance standards:

1. Stairs and platforms shall support a live load of one hundred (100) psf and a concentrated live load of three hundred (300) lbs. and shall have a live load deflection limited to 1/360 of the span. Loads shall not apply simultaneously.

2. Railings shall be designed to resist loads as specified in Article 3, Section 27-558 of the New York City Building Code.

1.6 SUBMITTALS

A. Manufacturer's Literature: Submit manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

B. Shop Drawings: Shop drawings for the fabrication and erection of all assemblies of miscellaneous iron work which are not completely shown by manufacturer's data sheets. Include plans and elevations at not less than 1" to 1'-0" scale, and include details of sections and connections at not less than 3" to 1'-0" scale. Show anchorage and accessory items.

C. Mockups: Provide galvanized steel grating and handrail mockup as indicated on construction documents.

D. Engineering Data

1. Before any stairs, ladders and railings are fabricated, submit engineering data drawings to the Commissioner for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of

members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

E. Welding shall be indicated on shop drawings using AWS symbols and showing length, size and spacing (if not continuous). Auxiliary views shall be shown to clarify all welding. Notes such as 1/4" weld, weld and tack weld are not acceptable.

F. Certification: For items to be hot-dip galvanized, identify each item galvanized and to show compliance of application. The Certificate shall be signed by the galvanizer and shall contain a detailed description of the material processed and the ASTM standard used for the coating and, the weight of the coating. In addition, and as attachment to Certification, submit reports of testing and inspections indicating compliance with the provisions of this Section.

G. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Metal fabrications required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with DDC General Conditions section 018113.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with DDC General Conditions section 018113.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of DDC General Conditions VOC Limits Section, where applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Metals

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Steel Plates, Shapes and Bars: ASTM A 36.

3. Steel Bar Grating: ASTM A 1011 or ASTM A 36.

4. Steel Tubing: Cold formed, ASTM A 500; or hot rolled, ASTM A 501.

5. Structural Steel Sheet: Hot rolled, ASTM A 570; or cold rolled, ASTM A 611, Class 1; of grade required for design loading.

6. Galvanized Structural Steel Sheet: ASTM A 924, of grade required for design loading. Coating designation G90.

7. Stainless Steel: Type 316 and Type 316L

8. Steel Pipe: ASTM A 53, type and grade as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (Schedule 40), unless otherwise indicated.

9. Gray Iron Castings: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

10. Malleable Iron Castings: ASTM A 47, grade as selected by fabricator.

11. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

12. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

B. Grout: Non-shrink, non-metallic grout conforming to the requirements of Section 033000.

C. Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

2. Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

3. Anchor Bolts: ASTM F 1554, Grade 36.

4. Lag Bolts: ASME B18.2.1.

5. Machine Screws: ASME B18.6.3.

6. Plain Washers: Round, carbon steel, ASME B18.22.1.

7. Masonry Anchorage Devices: Expansion shields, FS FF-S-325.

8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

9. Lock Washers: Helical spring type carbon steel, ASME B18.21.1.

D. Shop Paint: Shop prime all non-galvanized miscellaneous metal items using Series 88 Azeron Primer made by Tnemec, ICI Devoe "Rust Guard" quick dry alkyd shop coat No. 41403, or "Interlac 393" by International Protection Coatings or approved equal.

1. If steel is to receive high performance coating as noted in Section 099000, shop prime using primer noted in Section 099000.

E. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187.

F. Galvanizing Repair Coating: For touching up galvanized surfaces after erection, provide repair coating that is V.O.C. compliant, equal to "Silver Galv" made by Z.R.C. Worldwide or approved equal. Apply to a dry film thickness of 1.5 to 3.0 mils.

2.2 PRIME PAINTING

A. Scope: All ferrous metal (except galvanized steel) shall be cleaned and shop painted with one coat of specified ferrous metal primer. No shop prime paint required on galvanized steel or aluminum work.

B. Cleaning: Conform to Steel Structures Painting Council Surface Preparation Specification SP 3 (latest edition) "Power Tool Cleaning" for cleaning of ferrous metals which are to receive shop prime coat.

1. Steel to get high performance coating as noted in Section 099000 shall be cleaned as per SSPC SP.6 "Commercial Blast Cleaning."

C. Application

1. Apply shop prime coat immediately after cleaning metal. Apply paint in dry weather or under cover. Metal surfaces shall be free from frost or moisture when painted. Paint all metal surfaces including edges, joints, holes, corners, etc.

2. Paint surfaces which will be concealed after shop assembly prior to such assembly. Apply paint in accordance with approved paint manufacturer's printed instructions, and the use of any thinners, adulterants or admixtures shall be only as stated in said instructions.

3. Paint shall uniformly and completely cover the metal surfaces, 2.0 mils minimum dry film thickness. No work shall be shipped until the shop prime coat thereon has dried.

D. Touch-Up: In the shop, after assembly and in the field, after installation of work of this Section, touch-up damaged or abraded portions of shop prime paint with specified ferrous metal primer.

E. Apply one shop coat to fabricated metal items, except apply two (2) coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

2.3 GALVANIZING

A. Scope: All ferrous metal exposed to the weather, and all ferrous metals indicated on drawings or in specifications to be galvanized, shall be cleaned and then hot-dipped galvanized after fabrication as provided by Duncan Galvanizing or approved equal.

B. Avoid fabrication techniques that could cause distortion or embrittlement of steel items to be hot-dip galvanized. Fabricator shall consult with hot-dip galvanizer regarding potential warpage problems or handling problems during the galvanizing process that may require adjustment of fabrication techniques or design before finalizing shop drawings and beginning of fabrication.

C. Cleaning: Thoroughly clean metal surfaces of all mill scale, rust, dirt, grease, oil, moisture and other contaminants prior to galvanizing.

D. Application: Hot-dip galvanizing shall conform to the following::

1. ASTM A 143: Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel.

2. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM A 153: Galvanized Coating on Iron and Steel Hardware - Table 1.

4. ASTM A 384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

5. ASTM A 385: Practice for Providing High Quality Zinc Coatings.

6. ASTM A 924: Galvanized Coating on Steel Sheets.

7. Minimum weight of galvanized coating shall be two (2) oz. per square foot of surface.

E. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

F. All galvanized materials must be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the weight of the coating, and the appropriate ASTM number.

G. To minimize surface imperfection (eg: flux inclusions), material to be galvanized shall be dipped into a solution of Zinc Ammonium Chloride (pre-flux) immediately prior to galvanizing. The type of galvanizing process utilizing a flux blanket overlaying the molten zinc will not be permitted.

H. After galvanizing all materials not exposed to view must be chromated by dipping material in a 0.2% chromic acid solution.

I. Galvanized surfaces, where exposed to view, must have a smooth, level surface finish. Where this does not occur, piece shall be rejected and replaced to the acceptance of the Commissioner.

2.4 PROTECTIVE COATINGS

A. Whenever dissimilar metals will be in contact, separate contact surfaces by coating each contact surface prior to assembly or installation with one coat of specified bituminous paint or approved sheet membrane, which shall be in addition to the specified shop prime paint. Mask off those surfaces not required to receive protective coating.

2.5 WORKMANSHIP

A. General

1. Miscellaneous metal work shall be fabricated by an experienced fabricator or manufacturer and installed by an experienced tradesman.

2. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings and specifications, approved shop drawings, and best practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected.

3. All work shall be accurately and neatly fabricated, assembled and erected.

B. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Shop assemble work in largest practical sizes to minimize field work. It is the responsibility of the miscellaneous metal subcontractor to assure himself that the shop-fabricated miscellaneous metal items will properly fit the field condition. In the event that shop-fabricated miscellaneous metal items do not fit the field condition, the item shall be returned to the shop for correction.

C. Cutting: Cut metal by sawing, shearing, or blanking. Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Make cuts accurate, clean, sharp and free of burrs, without deforming adjacent surfaces or metals.

D. Holes: Drill or cleanly punch holes; do not burn.

E. Connections: Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to weather. Locate joints where least conspicuous. Unless indicated otherwise, weld or bolt shop connections; bolt or screw field connections. Provide expansion and contraction joints to allow for thermal movement of metal at locations and by methods approved by Commissioner.

1. Welding

   a. Shall be in accordance with AWS D1.1 Structural Welding Code of the American Welding Society, and shall be done with electrodes and/or methods recommended by the manufacturer of the metals being welded. Welds to comply with NOMMA Finish #1 standard.
   b. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces; undercut metal edges where welds are required to be flush.
   c. All welds on or behind surfaces which will be exposed to view shall be done so as to prevent distortion of finished surface. Remove weld spatter and welding oxides from all welded surfaces.

2. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Install all nuts & bolts to required torque. Use nylon insert hex lock nuts. Bolts and screw heads exposed to view shall be flat and countersunk. Size bolts and screws to engage full depth of nut and so length protruding does not exceed ¼".

F. Operating Mechanism: Operating devices (i.e. pivots, hinges, etc.) mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.

G. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items specified under this Section of the Specifications to be built into concrete, masonry or work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.

H. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

I. Coordination: Accurately cut, fit, drill and tap work of this Section to accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.

J. Exposed Work

1. In addition to requirements specified herein and shown on drawings, all surfaces exposed to view shall be clean and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs, and other defects which mar appearance of finished work.

2. Metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as per best industry standards , miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design.

3. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.

K. Preparation for Hot-Dip Galvanizing: Fabricator shall correctly prepare assemblies for galvanizing to the satisfaction of the galvanizer and in accordance with applicable Reference Standards and applicable AGA publications for the "Design of Products to be Hot-Dip galvanized After Fabrication." Preparation shall include but not be limited to the following:

1. Remove welding flux.

2. Drill appropriate vent holes and provide for drainage in inconspicuous locations of hollow sections and semi-enclosed elements. After galvanizing, plug vent holes with shaped lead and grind smooth.

2.6 MISCELLANEOUS METALS ITEMS

A. Rough Hardware

1. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

2. Fabricate items to sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood connections; elsewhere, furnish steel washers. Provide 'AN' type washers where practicable.

B. Ladders

1. Vertical steel ladders shall be eighteen (18) inches wide with 3/4" diameter non-slip steel rungs spaced twelve (12) inches o.c. Stringers shall be 3/8" thick by 2-1/2" wide steel bars; rungs welded to bars. Attach ladders to walls six (6) inches from top and bottom and maximum thirty-six (36) inches o.c. from these points. At the roof, gooseneck the rails back to the structure to provide secure ladder access.

2. Provide sloping ladders (ship's ladders) where noted. Fabricate open type construction with structural steel channel or steel plate stringers, pipe handrails, and open steel grating treads. Provide all necessary brackets and fittings for installation.

3. Ladders shall be fabricated to support a live load of one hundred (100) lbs. per square foot and a concentrated load of three hundred (300) lbs. per rung; loads not to act simultaneously.

C. Open Riser Service Stairs

1. General: Construct stairs to conform to sizes and arrangements shown; joint pieces together by welding. Provide complete stair assemblies, including metal framing, hangers, railings, newels, balusters, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure.

2. Stair Framing: Fabricate stringers of structural steel channels, or plates, or a combination thereof. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as shown. Bolt or weld headers to strings and newels and framing members to strings and headers; fabricate and join so that bolts, if used, do not appear on finish surfaces.

3. Attach treads to stringers by means of brackets made of steel and angles or bars. Weld brackets to strings and attach metal treads to brackets by welding, riveting or bolting.

4. Provide platforms of same metal as treads and in thicknesses required to support design loading. Attach platform to platform framing members with welds.

5. Steel Floor Plate Treads and Platforms: Provide raised pattern steel floor plate complying with FS QQ-F-461, Class I. Provide diamond pattern.

   a. Form treads of 1/4" thick steel floor plate with integral nosing and back edge stiffener. Weld steel supporting brackets to strings and treads to brackets.
   b. Fabricate platforms of steel floor plate. Provide nosing matching that on treads at all landings. Secure to platform framing members with welds.

D. Loose Steel Lintels

1. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown. Weld adjoining members together to form a single unit where indicated. Provide not less than eight (8) inches bearing at each side of openings, unless otherwise indicated.

   a. Lintels and shelf angles shall be bent or rolled angles, fabricated of stainless steel Type 316. All angles shall conform to the sizes, shapes, dimensions and details as noted on Drawings. The lintels assembled by welding shall be fabricated of stainless steel Type 316L.
   b. All mounting and assembly hardware shall be Type 316 stainless steel.

2. Loose lintels shall conform to the following Schedule:

Opening Width (Maximum)	WALL THICKNESS		
	4 inches	6 inches	8 inches*
2'-0"	3-1/2" x 3-1/2" x 1/4"	6" x 4" x 5/16"	3-1/2" x 3-1/2" x 1/4"
3'-0"	3-1/2" x 3-1/2" x 5/16"	6" x 4" x 5/16"	3-1/2" x 3-1/2" x 5/16"
4'-0"	3-1/2" x 3-1/2" x 5/16"	6" x 4" x 5/16"	3-1/2" x 3-1/2" x 5/16"
5'-0"	4" x 3-1/2" x 3/8"	6" x 4" x 3/8"	4" x 3-1/2" x 5/16"
6'-0"	5" x 3-1/2" x 3/8"	6" x 4" x 3/8"	5" x 3-1/2" x 5/16"
7'-0"	5" x 3-1/2" x 3/8"	5" x 5" x 1/2"	5" x 3-1/2" x 3/8"
8'-0"	5" x 3-1/2" x 3/8"	5" x 5" x 5/8"	5" x 3-1/2" x 3/8"

* Two angles at all openings in eight (8) inch walls.

3. At columns or vertical surfaces where lintels cannot bear on masonry, provide clip angles sized for structural capacity of lintel.

E. Miscellaneous Light Steel Framing

1. Light steel framing, bracing, supports, framing, clip angles, shelf angles, plates, etc., shall be of such shapes and sizes as indicated on the drawings and details or as required to suit the condition and shall be provided with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and all other connecting and adjoining work.

2. All light steel framing steel shall be furnished and erected in accordance with the applicable requirements of the "Specifications for the Design, Fabrication and

Erection of Structural Steel for Buildings" by the American Institute of Steel Construction and as specified herein.

F. Steel Gratings and Frames

1. Provide hot dipped galvanized steel gratings complying with FS RR-G-661 with rectangular cross bars welded to bearing bars. Bars to have plain wearing surface.

2. Manufacturer: Provide gratings manufactured by Reliance, Borden, Irving Subway Grating, or approved equal.

3. Hinged Section: Provide hinged sections in areaway gratings where required by the drawings. Each hinged section up to 4'-0" wide shall be provided with two (2) five knuckle, fast pin, regular weight, plain bearing, wrought bronze butt hinges. Each hinged section over 4'-0" wide shall be provided with three (3) butt hinges. Hinged sections shall have provisions for padlocking on the underside.

4. Furnish grating frames, with corners mitered, welded and ground smooth, and with welded-on straps for secure anchorage into concrete. Frames and anchors to be galvanized.

5. Structural Performance: Provide gratings capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Provide calculations or manufacturer's written guarantee of the following:

   a. Floors: Capable of withstanding a uniform load of 250 lbf/sq. ft. or a concentrated load of 3000 lbf, whichever produces the greater stress.
   b. Walkways and Elevated Platforms Other Than Exits: Capable of withstanding a uniform load of 60 lbf/sq. ft. Limit deflection to L/360 or 1/4", whichever is less.
   c. Walkways and Elevated Platforms Used as Exits: Capable of withstanding a uniform of 100 lbf/sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress. Limit deflection to L/360 or 1/4", whichever is less.
   d. Sidewalks and Vehicular Driveways: Capable of withstanding a uniform load of 250 lfb/sq. ft. or a concentrated load of 8000 lbf, whichever produces the greater stress.

G. Pit Covers and Frames: Provide minimum 1/2" thick steel checkered plate cover, reinforced as required to limit deflection to 1/360 of span, with two (2) recessed lifting handles capable of supporting five hundred (500) lbs. each. Furnish covers with steel angle frames, with corners mitered, welded and ground smooth, and with welded-on straps for secure anchorage into concrete. Frames and anchors to be galvanized. Plate covers shall be capable of supporting same loads as adjacent floor surfaces.

H. Structural Steel Door Frames

1. Fabricate steel door frames of structural shapes and bars, fully welded, uniform, square and true. Plug weld built-up members, continuously weld exposed joints; grind exposed welds smooth. Provide 5/8" x 1-1/2" steel bar stops. Secure

removable stops to frame with countersunk machine screws, uniformly spaced at not more than ten (10) inches o.c.

2. Provide necessary reinforcements and drill and tap as required for finish hardware.

3. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8" x 2" straps of the length required for a minimum eight (8) inch embedment. Weld anchors to frame jambs no more than twelve (12) inches from both bottom and head of frame and space anchors not more than thirty (30) inches apart.

4. Extend bottom of frames to floor elevation and secure to concrete with steel angle clips welded to frames, anchored with expansion shields and bolts.

I. Cast Thresholds

1. Fabricate of sizes and configurations as shown. Provide cast iron units with integral abrasive finish. Furnish in lengths as required to accurately fit each opening or condition.

   a. Cast units with an integral abrasive grit consisting of aluminum oxide, silicone carbide, or a combination of both.

2. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

   a. Provide two (2) rows of holes for units over five (5) inches wide, with two (2) holes aligned at ends and staggered intermediate holes.

3. Apply black asphaltic coating to concealed bottoms, sides and edges of cast iron units set into concrete.

4. Provide a diamond surface texture.

J. Safety Nosings for Interior Concrete Steps

1. Provide three (3) inch wide, Style A cast iron safety nosing with hatched abrasive surface extending to end of stringers, manufactured by American Abrasive Metals Co., or equal made by Wooster Products Inc., American Mason Safety Tread Co., or approved equal.

2. Provide anchors spaced not more than four (4) inches from each end and not more than twelve (12) inches o.c. Furnish nosings to concrete trades for installation.

3. Apply asphaltic coating to surfaces in contact with concrete.

K. Steel Bollards: Provide six (6) inches O.D. extra strong (Schedule 80) steel pipe, concrete filled, with base of steel plate for mounting to anchor bolts in concrete foundation. Rabbet top of steel pipe and insert 1/4" steel plate cap, flush with top of pipe. Weld top of cap to pipe and grind smooth and flush.

L. Miscellaneous Steel Trim: Provide shapes and sizes for profiles shown. Except as otherwise indicated, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

M. Corner Guards: Provide steel corner guards where shown. Unless otherwise indicated, use 4" x 4" x 1/4" steel angles to a height of four (4) feet above finished floor with 1-1/4" x 8 1/4" bent steel strap anchors welded to backs of angles at each end and approximately sixteen (16) inches o.c. Set and adjust guards to finish flush with adjacent surfaces.

1. CG-01: Metal Corner Guard. Metal corner guard shall be fabricated to dimensions and details indicated in the Contract Drawings.

2. Finish: Galvanized

N. Countertop Supports: Steel framing as indicated or required to support countertops. Conceal framing under countertops and within wall behind countertops. Provide supports to withstand a concentrated load of not less than three hundred (300) lbs. applied at any point with a deflection not to exceed L/240 for the length of the countertop.

O. Steel Floor Access Door: Provide Series JD steel floor access door for interior use with checkered plate top, angle iron frame and manufacturer's standard hardware as manufactured by Bilco or equal made by Babcock-Davis, Dur-Red Products or approved equal; size as shown on drawings.

P. Masonry Support Steel

1. Provide galvanized steel, relieving angles, plates, accessories and other steel shapes for masonry support steel; for lintels refer to Para. E. herein.

2. Fabricate masonry support steel to allow final adjustment with the closest tolerances possible. Relieving angles which require cutting to fit masonry flashing shall be straightened without deflections.

3. Coordinate masonry support system with concrete work for locations of wedge inserts.

4. Install to meet requirements of building masonry work, face brick coursing and stone placement. Coordinate final adjustments with masonry work as work progresses.

Q. Sleeves in Concrete Walls and Slabs

1. Sleeves through concrete walls shall be of Schedule 40 steel pipe with i.d. two (2) inches larger than o.d. of pipe or conduit (including insulation, if any) to be accommodated. Sleeves shall project one-half (1/2) inch on each side of finished wall. Provide rectangular one-quarter (1/4) inch steel plate collar at center, continuously welded to the perimeter of the sleeve, and six (6) inches wider than the o.d.

2. Slots in slabs shall be 12 gauge steel sheet, galvanized, of dimensions indicated, with strap anchors welded in place not more than twelve (12) inches on centers.

R. Exterior Stair #1 - Bent Metal Plate Treads & Risers

1. Bent Metal Plate Slip Resistant Treads - 'SlipNot Grip Plate' - #316 Grade 2(Medium) Stainless on Stainless Steel by W.S. Molnar Company 2545 Beaufait St Detroit Michigan, 48207 or approved equal

2. Bent Metal Plate Perforated Risers – 'SlipNot Perforated Plate' – Flex Grip , #316 Grade 2(Medium) Stainless on Stainless Steel by W.S. Molnar Company 2545 Beaufait St Detroit Michigan, 48207 or approved equal

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where miscellaneous metal is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 ERECTION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.

C. Fitting Connections: Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance, and quality of welds made, and methods used in correcting welding work.

E. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

F. Field Touch-Up of Galvanized Surfaces: Touch-up shop applied galvanized coatings damaged during handling and installation. Use galvanizing repair coating specified herein for galvanized surfaces.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 055020

WEATHERING STEEL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish and install weathering steel as shown on the Drawings and as specified herein.

1.3 RELATED SECTIONS

A. Miscellaneous Metals - Section 055000.

B. Ornamental Metals - Section 057000.

1.4 REFERENCES

A. ASTM A 588: Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi minimum yield point, with Atmospheric Corrosion Resistance

B. ASTM A 606: Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance

1.5 SUBMITTALS

A. The Contractor shall submit to the Engineer for approval, shop drawings and other material required to substantiate conformance with the requirements set forth on the Contract Drawings and these Specifications in accordance with the General Conditions - Contractor's Working Drawings, Design and Shop Drawings; and the submittal procedures of the DDC General Conditions.

B. Working Drawings shall include, but not be limited to, outline and dimensional drawings including detailed sections and materials specifications and as follows:

1. Layout drawings showing all structural shapes, sizes and dimensions.

2. Certifications, schedules, design calculations, detailed drawings, plans, elevations, and details of sections, connections and profiles required for all metal fabrications associated with the work.

3. Detailed drawings shall include jointing and anchorage details, including anchor bolt locations, sizes and setting drawings.

4. Drawings showing the sequence of erection, where required.

5. Manufacturer's specifications, load tables, installation instructions, setting drawings and templates for location of miscellaneous metal items and appurtenances.

6. Working Drawings: Working Drawings shall be submitted to Engineer and shall show all component details, joint pattern, openings, bearing, anchorage, loading, welds, frame anchor layout, lifting hook locations, type and location of fasteners, egress hardware per applicable codes and regulations, and accessories or items required for other related Work. Working Drawings shall indicate method for securing weathering steel panels to building frame and all loads imposed.

7. Drawings and Calculations: The Contractor shall submit calculations for loadings and stresses of weathering steel cladding panels and swinging gate with hinges, prepared, signed and sealed by a Professional Engineer licensed to practice and registered in the State of New York.

8. Samples: The Contractor shall submit, to Engineer, three samples of each type of weathering steel to be used in exterior panels that are representative of the color, texture, and extremes of color range, including weathering over time, of the material to be provided. Where panels are specified to be sealed, provide samples with sealer applied.

C. No fabrication shall be started until Working Drawings and Shop Drawings have been approved by the Engineer.

D. The following shall also be submitted:

1. Manufacturer's specifications, load table, installation instructions, setting drawings and templates for location and installation of miscellaneous metal items, appurtenances and anchorage devices.

2. Certified weld inspection reports.

E. The following samples shall be furnished: Representative samples of bolts, anchors, gate hinge, and inserts as requested by the Engineer. The Engineer's review shall be for type and finish only. Compliance with all other requirements shall be the exclusive responsibility of the Contractor.

F. Record Drawings: During progress of the work, an up to date set of drawings showing Field and Working Drawing modifications shall be kept. Immediately upon completion of work, Record Drawings showing the actual in-place installation of all work constructed and/or installed under this Section as specified in the General Conditions shall be provided. Drawings shall include all necessary plans, sections and details, with all reference dimensions and elevations required for complete Record Drawings of the work.

1.6 QUALITY ASSURANCE AND QUALIFICATIONS

A. Performance Criteria

1. Elastic deflection of panels under wind load shall not exceed 1/2" at any point.

B. Shop inspections may be made by the Commissioner. The Contractor shall give ample notice to the Commissioner prior to the beginning of any fabrication work so that inspection may be provided. The Contractor shall furnish all facilities for the inspection of materials and workmanship in the shop, and the inspectors shall be allowed free access to the necessary parts of the works.

C. Inspectors shall have the authority to reject any materials or work which does not meet the requirements of these Specifications.

D. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but is expressly understood that it will in no way relieve the Contractor from his responsibility for furnishing proper materials or workmanship under this Specification.

E. Design of Members and Connections:

1. All details shown are typical. Similar details apply to similar conditions, unless otherwise shown or specified.

2. Each fabricator shall be responsible for calculations required to comply with performance criteria specified or contained in standard documents specified.

3. Complete design calculations required to show compliance shall be prepared, signed and stamped with the seal of a Registered Professional Engineer, licensed to practice in the State of New York, and recognized as an expert in the required work.

F. Tolerances: Joints between panels shall be as shown on Contract Drawings. Panels shall be installed such that gaps shown on Drawing are accurate to within plus or minus 1/8 inch measured along any panel dimension.

G. Shop Assembly:

1. All items shall be preassembled in the shop to the greatest extent possible so as to minimize assembly at the Site.

2. Units shall be disassembled only to the extent necessary for shipping and handling limitations. All units shall be clearly marked for reassembly and coordinated installation.

H. Qualifications: The Contractor shall have at least three (3) years' experience in installations similar to the work specified herein.

1.7 DELIVERY, STORAGE AND HANDLING

A. Weathering steel shall be handled in such a manner that they may be transported and unloaded without being over-stressed, deformed or otherwise damaged.

B. Weathering steel and packaged materials shall be protected from corrosion and deterioration and shall be stored in a dry area. Materials stored outdoors shall be supported above ground surfaces on wood runners and protected with effective and durable covers approved by the Commissioner.

C. Weathering steel shall not be placed in or on a structure in a manner that might cause distortion or damage to the fabrication. The Contractor shall repair or replace damaged weathering steel or materials as directed by the Commissioner.

D. All items shall be delivered to the Site at such intervals as to insure uninterrupted progress of the work. Anchor bolts, anchorage devices, and similar items that are to be embedded in cast-in-place concrete or masonry shall be delivered so as not to delay that work.

1.8 FIELD MEASUREMENTS

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work.

B. The Contractor shall review the Contract Drawings and any discrepancies shall be reported to the Engineer for clarification prior to start of fabrication.

1.9 VISUAL INSPECTION

A. Mobile Sample Panel: Provide 2 feet x 2 feet mobile sample panel that can be moved around site for comparing consistency of finish in various locations on site. Panel shall also be used for Contractor demonstration of damage rectification.

1.10 GREEN BUILDING GENERAL REQUIREMENTS

A. Metal in this section shall contain recycled content as available.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural steel shapes shall be fabricated in accordance with the details shown on the Contract Drawings and shall conform to the requirements of Section 051200 - Structural Steel, and ASTM A 36, unless otherwise indicated.

2.2 WEATHERING STEEL CLADDING

A. External solid weathering steel Panels at Weir Walls and Cell 1 Trough.

B. Provide weathering steel cladding as indicated on the Drawings.

C. Provide weathering steel panels, hot-rolled and preweathered conforming to ASTM A 606, finish E matt, dry condition, and ASTM A 588; US Steel Cor-ten or approved equal.

D. Thickness: As required by performance criteria but not less than 3/8 inch.

E. Panels shall be preweathered prior to installation. Store panels outside for two-three months with 100 cycle spray watering. Provide progress reports of pre-weathering process (every 10th cycle on 12" x 12" weathered steel sample material, type and thickness to be same as production materials).

2.3 WEATHERING TRASH RACK INFILL PANELS

A. WS-04: External weathering steel infill panel at trash rack.

1. Provide weathering steel infill panel at trash rack as indicated on the Drawings.

2.4 WS-01 WEATHERING STEEL DOVETAIL GRATES

A. Provide lockable weathering steel hasp at operable gates

B. All welds to be ground smooth prior to weathering

1. VERTICAL BARS: 3/16" Thickness X 1" Depth

2. VERTICAL BARS: 1 3/16" O.C. (1" Clearance Between Vertical Bars)

C. HORIZONTAL CROSS BARS

1. 1/8" X ¾" Horizontal Cross Bar Recessed ¼" From One Face Of The Vertical Bars. The Horizontal Cross Bar Shall Be Sheer Cut From Plate.

D. HORIZONTAL CROSS BAR: 4" O.C.

E. Provide custom gratings by:

1. Ohio Grating

2. Mariani Metals

3. Approved Equal

2.5 WS-01 WEATHERING STEEL TROUGH AT WATER FEATURE

A. Provide weathering steel water supply trough as shown on the drawing.

B. All panels and joints between panels to be plumb. The top of the trough will be completely level, with a tolerance of ¼" over the 60 foot span. The joints between panels shall be plumb and an even width across their length, as written on the drawings. Any panel installation that does not meet the standards written herein will be replaced at the Contractor's expense.

C. All panels to be pre weathered and to have an even tone. Any marked discolorations, scratches, or blemishes will not be accepted.

D. Provide a continuous bead of epoxy along all non-exposed edges of the interior of the supply trough.

E. The weld between panels shall be watertight.

2.6 WS-01 WEIR PLATES

A. Provide weathering steel weirs as shown on the drawing.

B. All sharp edges shall be removed and all edges shall have a 1/16" radius. All welds to be ground smooth prior to weathering.

C. All weirs shall be pre weathered and have an even tone. Any marked discolorations, scratches, or blemishes will not be accepted.

D. Provide a continuous bead of epoxy along all non-exposed edges (do not apply epoxy at any visible surfaces). Water shall only exit from the designated spout as per the drawings, and water shall not leak through the edges of the weir. Any leaking will require the removal of said weir and the replacement at no cost to the City of New York.

PART 3 EXECUTION

3.1 INSPECTION

A. The Contractor shall examine the alignment of the substrate and conditions under which weathering steel work is to be performed and notify the Engineer in writing of unsatisfactory conditions. Do not proceed with the weathering steel cladding and installation work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.2 FABRICATION

A. Fabrication of all exposed weathering steel shall conform to Section 051213, "Architecturally Exposed Structural Steel (AESS)."

B. Fabrication of steel shall be in accordance with the Specification for the Design Fabrication and Erection of Structural Steel for Building of the AISC.

C. Holes for bolts and screws shall be drilled. Fastenings shall be concealed where practicable. Joints exposed to the weather shall be formed to exclude water.

D. As far as practicable, all fabricated units shall be fitted and assembled in the shop, with all cuts and bends made to precision measurements in accordance with details shown on approved shop drawings.

E. Work shall be fabricated so that it is installed in a manner that will provide for expansion and contraction, prevent the shearing of bolts, screws and other fastenings, ensure rigidity, and provide close fitting of sections.

F. Welding of carbon and low alloy steel shall conform to the applicable requirements of ANSI/AWS D1.1. Welding shall be done in a manner that will prevent permanent buckling and all welds exposed in the finished work shall be ground smooth.

1. Welding rods shall be selected to closely match the color and texture of the weathering steel panels.

G. All finished and/or machined faces shall be true to line and level. Steel shall be standard, and well finished. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves.

H. All work shall be fitted together at the shop as far as possible, and delivered complete and ready for erection. Proper care shall be exercised in handling all work so as not to damage the finished surfaces.

3.3 INSTALLATION

A. Weathering steel shall be erected square, plumb and true, accurately fitted, adequately anchored in place, set at proper elevations and positions.

B. All inserts, anchor bolts and all other miscellaneous metal work specified in the Detailed Specifications or shown on the Contract Drawings or required for the proper completion of the work, which are embedded in concrete, shall be properly set and securely held in position in the forms before the concrete is placed.

C. All weathering steel shall be installed in conformance with details shown on the Contract Drawings or on the approved shop drawings.

3.4 ERECTION

A. Panels shall be erected level and plumb within allowable tolerances, without damage to shape or finish. Damaged panels shall be replaced with new panels as specified herein, at no additional expense to the City. Horizontal and vertical panel joints shall be aligned and maintained uniformly as erection progresses.

B. Frame for Mesh Trash Rack: Frame for mesh trash rack shall be fastened and welded in place in accordance with approved Working Drawings. Welding, including tack welds, shall be in accordance with AWS D 1.1.

C. Touch Up: All field welds and scratched or damaged weathering steel surfaces shall be touched up in accordance with manufacturer's recommendations.

D. Built In Work: Built-in items furnished by other Sections of the work, such as anchor bolts, plates, and the like, shall be installed plumb and level. Panels shall be cut, reinforced and fit for pipe, conduit, sleeves, grounds, and the similar penetrations, and shall be coordinated with other Sections of the work to provide correct size, shape, and location. Approval of the Engineer shall be obtained prior to cutting or fitting panels not indicated to be cut or penetrated on approved Working Drawings, or where appearance or strength of panels may be impaired.

E. Installation Tolerances: Tolerances shall conform to the following:

1. Maximum Variation From Panel to Adjacent Panel: 1/4-inch

2. Maximum Variation From Intended Plane of Wall: 1/4-inch in 10 feet

3. Maximum Variation of Panel Joint Thickness: 1/8-inch in 20 feet

F. Weathering Trash Rack Mesh Infill Panel: Install in accordance with approved Working Drawings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 055210

STEEL PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the steel pipe and tube railings as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Galvanized steel pipe railings.

1.3 RELATED SECTIONS

A. Miscellaneous metals – Section 055000.

B. Ornamental Metals - Section 057000, for stainless steel tube and cable railings.

C. Painting and finishing – Section 099000.

1.4 DESIGN CRITERIA

A. Provide railings, including comprehensive engineering analysis by a qualified professional Engineer licensed in the State of New York using performance requirements and design criteria indicated.

1. Uniform load of 50 lbf/ft. applied in any direction.

2. Concentrated load of 200 lbf applied in any direction.

3. Uniform and concentrated loads need not be assumed to act concurrently.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

3. Where prevailing Code requirements require greater loads, such loads shall apply.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible material

1.5 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.

2. Railing brackets.

3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work and calculations signed and sealed by a professional engineer licensed in the state of New York

C. Mockups – Provide mockups as indicated on the construction documents.

D. Samples: For each type of exposed finish required.

E. Engineering Services Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Professional Engineer licensed in the State of New York responsible for their preparation.

F. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material

listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Metal fabrications required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with DDC General Conditions section 018113.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with DDC General Conditions section 018113.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of DDC General Conditions VOC Limits Section, where applicable.

PART 2 PRODUCTS

2.1 METALS

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

E. Stainless steel Tensioning Cable and hardware: Wagner Invisiware Swaged Tensioning Hardware and Cable System.

1. 1 x 19 stainless steel cable.

2. Tension Fittings: Invisiware Received

2.2 MISCELLANEOUS MATERIALS

A. Fasteners: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.3 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Comply with NOMMA Finnish #1 standard.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Nonwelded Connections: Where noted on approved shop drawings, connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

E. Form changes in direction by inserting prefabricated elbow fittings.

F. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

G. Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers to transfer loads through wall finishes.

2.4 FINISH

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.

2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.

3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning":

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Do not apply primer to galvanized surfaces.

E. Refer to Section 099000 for finish painting.

PART 3 EXECUTION

3.1 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Anchor posts in concrete by inserting into core-drilled holes and grouting annular space.

D. Anchor posts to metal surfaces with oval flanges.

E. Anchor railing ends at walls with round flanges anchored to wall construction.

F. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

G. Attach railings to wall with wall brackets. Use type of bracket with flange tapped for concealed anchorage.

H. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

2. For hollow masonry anchorage, use toggle bolts.

3. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.3 GALVANIZED WORK SCHEDULE

A. GR-02 Galvanized handrail – Galvanized steel pipe posts and related galvanized hardware + accessories

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 057000

ORNAMENTAL METALS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the ornamental metals, including heavy gauge stainless steel and non-ferrous metal products which are used in building construction for functional, architectural, and decorative effects, and which are not a part of other metal systems specified in other Sections. The extent of these items is indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Galvanize guardrail system ith tension stainless steel cables.
2. Stainless steel cable guardrail infill.
3. Fin tube radiator cover
4. Drain covers.
5. Coverplates/Fasteners
6. Stainless steel cable mesh for driving range gate and metal fence balustrade.

1.3 RELATED SECTIONS

A. Miscellaneous metals - Section 055000.

B. Steel Pipe and Tube Railings - Section 055210, for galvanized steel railings.

1.4 QUALITY ASSURANCE

A. General: Work of this section shall be fabricated and installed by an experienced fabricator or manufacturer who has been engaged in work of equivalent scope and fabrication standards for at least three (3) years. Materials, methods of fabrication, fitting, assembly, bracing, supporting, fastening, operating devices, and erection shall be in accordance with drawings, specifications, and approved shop drawings, and be of highest quality practices of the industry, using new and clean materials as specified, having structural properties sufficient to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. All work shall be accurately and neatly fabricated, assembled, and erected.

B. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting of the work. However, do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay the work.

C. Shop Assembly: Insofar as practicable, fitting and assembly of work shall be done in shop. Work that cannot be permanently shop assembled, shall be completely assembled, marked and disassembled in shop before shipment to insure proper assembly in field. Shop assemble work in largest practical sizes to minimize field work. It is the responsibility of the Contractor for this work to assure himself that the shop fabricated items will properly fit the field condition. In the event that shop fabricated items do not fit the field condition, the item shall be returned to the shop for correction.

D. Mockup: Before proceeding with final purchase of materials and fabrication of GR-01 components, prepare a mock-up at the Site, including all components shown on approved Working Drawings, indicating the final relationship and configurations of the various parts and components and the quality of workmanship that shall be achieved in the work

1. Build mock-up at guardrail pipe and post connection as indicated on the contract documents.

2. Build mock-up to include all items that are part of the GR-01 guardrail system including anchorages and sealants.

3. Incorporate materials and methods of fabrication and installation that are identical with Project requirements. Accepted mock-up may be incorporated into the finished work.

4. Build as many mock-ups as required to obtain Commissioner's acceptance. Disassemble rejected mock-ups and remove all components from Site. Do not incorporate rejected mock-up components into the work.

5. GR-01 guardrail installation that proceeds without an approved mock-up shall be stopped, and a mock-up prepared for Commissioner's approval.

6. Drain Covers: Trench drain grate – furnish and install one 'small trench drain' mockup in association with concrete plank paving mockup, see Specification 321313 Concrete Paving. Mockup to be used as the basis for acceptable workmanship.

E. Engineering Data

1. Before any balustrade assemblies are fabricated, submit engineering data drawings to the Architect for review indicating how performance standards specified here shall be met. The Contractor is responsible for the structural design and supports for these systems and must show his proposed systems on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of

members. Calculations and drawings must be prepared by a Structural Engineer licensed in the State of New York and shall be signed and sealed by this Engineer.

1.5 PERFORMANCE STANDARDS

A. Mesh fence balustrade shall be constructed to conform to the following performance standards:

1. Railings shall be designed to resist loads as of the New York City Building Code.

1.6 SUBMITTALS

A. Shop Drawings: Submit drawings and calculations signed and sealed by a Professional Engineer licensed to practice and registered in the state of New York for all items of work of this Section, as enumerated under paragraph 1.2, showing locations, layouts, materials, thicknesses, finishes, dimensions, construction, relation to adjoining construction, erection details, profiles, jointing and all other details to fully illustrate the work of this Section.

B. Samples: Submit fabricated samples to fully show construction, materials and finishes of all items of work as enumerated under paragraph 1.2 herein, and as follows.

1. GR-01: Submit sample 12 inches by 24 inches, including guardrail pipe and post connection, post waterjet cut pattern, cables, hardware and fasteners, demonstrating product type, color and finish.

2. FT-01: Submit sample 12 inches by 12 inches, demonstrating product type, color and finish.

3. FT-02: Submit sample 12 inches by 12 inches, demonstrating product type, color and finish.

4. MF-01: Submit sample 12 inches by 12 inches, demonstrating product type and finish.

5. Drain covers: provide one full size sample of small trench drain grate and small round drain cover, as per the drawings.

C. Product Data: Submit manufacturer's, fabricator's and finisher's specifications and installation instructions for products used in ornamental metal work, including finishing materials and methods.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113. Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of DDC General Conditions section 018113. For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Stainless steel and miscellaneous metals required for work in this Section shall contain a minimum of 20% (combined) pre-consumer/post consumer recycled content as available.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with DDC General Conditions section 018113.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of DDC General Conditions VOC Limits Section, where applicable.

1.8 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the City of New York.

C. See Part 3 for additional cleaning and handling requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide materials which have been selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Exposed to view surfaces which exhibit pitting, seam marks, roller marks, "oil-canning," stains, discolorations, or other imperfections on the finished units will not be acceptable.

B. Stainless Steel

1. Comply with the following standards for the forms and types of stainless steel for the required items of work.

a. Pipe: ASTM A 312, Grade TP 304.
b. Sheet, Strip, Flat Bar and Plate: ASTM A 666, Type 304.
c. Tubing: ASTM A 554, Grade MT 304.
d. Castings: ASTM A 743A, Grade CF 8 or CF 20.
e. Bars and Shapes: ASTM A 276, Type 304.

2. All exterior stainless steel shall be 316 Grade.

C. Stainless Steel Cable Mesh: Webnet by Jakob Inox.

1. Material: ASTM A492 Type 316 stainless steel 7 x 7 wire rope joined with seamless ferrules.

2. Cable Diameter: 2.0mm.

3. Mesh Aperature Dimensions: As indicated on drawings.

4. Mesh Perimeter Finishes: Closed loop with loose ferrules.

5. Direction (Grain) of Mesh: As indicated on drawings.

6. Seamless AISI 316L stainless steel ferrule.

7. Angled steel frame.

D. Malleable Iron Castings: ASTM A 48, Class 30, and shall be uniform in quality, free from blow holes, porosity, hard spots, shrinkage defects, swells, cracks or other defects. Surfaces shall be smooth and true to pattern.

E. Steel (Carbon)

1. Structural Shapes: ASTM A 36.

2. Plates (for forming or bending cold): ASTM A 283, Grade C.

3. Steel Sheets: ASTM A 366, Grade 1.

4. Galvanizing per Section 055210.

F. Galvanized waterjet cut steel posts. See detail sheet CROB_A-887 and 888.

G. All castings shall be of uniform quality, free from blow holes, shrinkage defects, swells, cracks, or other defects. Casting will be free of fins, burrs and slag

H. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of the metal to be welded, and as required for color match, strength and compatibility in the fabricated items.

I. Fasteners: Furnish basic metal and alloy, matching finished color and texture as the metal being fastened, unless otherwise indicated. Provide Hex flat-head screws for exposed fasteners, unless otherwise indicated.

J. Anchors and Inserts: Either furnish inserts to be set in concrete or masonry work, or provide other anchoring devices as required for the installation of ornamental metal items. Provide toothed steel or lead shield expansion bolt devices for drilled-in-place anchors. Provide galvanized or cadmium-coated anchors and inserts for exterior installations.

1. Provide units with exposed surfaces matching the texture and finish of the metal item anchored.

K. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

L. Cast-in-Place and Preinstalled Anchors: Anchors fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete.

2.2 FABRICATION

A. Cutting: Flame cutting will be permitted only if cut edges are ground back to clean, smooth edges. Chemically remove any surface de-coloration. Make cuts accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces or metals.

B. Holes: Drill or cleanly punch holes (do not burn), so that holes will be accurate, clean, neat and sharp without deforming adjacent surfaces or metals.

C. Connections

1. Make connections with tight joints, capable of developing full strength of member, flush unless indicated otherwise, formed to exclude water where exposed to water. Locate joints where indicated on drawings. Provide connections to allow for thermal movement of metal at locations and by methods approved by Commissioner. For work exposed to view, use concealed fasteners (unless welded or other connections indicated) with joints accurately fitted, flush and rigidly secured with hairline contacts.

2. Welding: Welding shall be in accordance with recommendations of the American Welding Society and shall be done with electrodes and/or methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Welds exposed to view shall be ground flush and dressed smooth with and to match finish of adjoining surfaces so that joint will not be visible; undercut metal edges where welds are required to be ground flush and dressed smooth. All welds on or behind surfaces which will be exposed to view shall be done so that finished surface will be free of imperfections such as pits, runs, splatter, cracks, warping, dimpling, depressions or other forms of distortion or discoloration. Remove weld splatter and welding oxides from all welded surfaces. Welding to comply with NOMMA Finish #1 standards.

3. Bolts and Screws: Make threaded connections tight with threads entirely concealed. Use nylon insert hex or pignose lock nuts unless otherwise specified. Bolts and screw heads, where shown to be exposed to view, shall be flat and countersunk. Coordinate bolt length and install bolts which protrude ¼" maximum from face of nuts at adjacent metal.

D. Operating Mechanism: Operating devices, mechanism and hardware used in connection with this work shall be fabricated, assembled, installed and adjusted after installation so that they will operate smoothly, freely, noiselessly and without excessive friction.

E. Built-In Work: Furnish anchor bolts, inserts, plates and any other anchorage devices, and all other items for architectural metal work to be built into concrete, masonry, or work of other trades, with necessary templates and instructions, and in ample time to facilitate proper placing and installation.

F. Supplementary Parts: Provide as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

G. Coordination: Accurately cut, fit, drill and tap work of this Section to accommodate and fit work of other trades. Furnish or obtain, as applicable, templates and drawings to or from applicable trades for proper coordination of this work.

H. Exposed Work: In addition to requirements specified herein or shown on drawings, all surfaces exposed to view shall be clean, and free from dirt, stains, grease, scratches, distortions, waves, dents, buckles, tool marks, burrs and other defects which mar appearance of finished work. Ornamental metal work exposed to view shall be straight and true to line or curve, smooth arrises and angles as sharp as practicable, miters formed in true alignment, profiles accurately intersecting, and with joints carefully matched to produce continuity of line and design. Exposed fastenings, where permitted, shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated, and shall be of the smallest practicable size.

I. Materials used shall be of such strength, thickness and alloy that they are capable of meeting all standards and descriptions specified herein and as detailed on drawings.

2.3 SHOP FINISHING

A. General

1. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations, except as otherwise indicated.

2. Provide colors or color matches as indicated on selected samples.

3. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

4. Corrosion Protection: Coat concealed surfaces which will be in contact with concrete, masonry, wood or dissimilar metals, in exterior work and work to be built into exterior and below grade walls and decks, with a heavy coat of bituminous paint or an applicable sheet membrane. Do not extend coating onto exposed surfaces.

B. Stainless Steel

1. Remove or blend tool and die marks and stretch lines into finish.

2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece unless indicated differently on construction documents.

3. Directional Brushed Satin No. 4 finish. As approved by Commissioner in sample.

4. When surface preparation is complete, passivate and rinse surfaces. Remove foreign matter and leave surface chemically dry.

C. Cast Iron: Cast Iron shall be pre-weathered and have received the final coloration prior to installation.

2.4 PROTECTION

A. Provide necessary protection to all exposed surfaces of architectural metal work, so as to prevent damage, staining, discoloration, abrasion, etc., to these surfaces from time of shipment from factory to acceptance of work of this project. Protection shall be provided by wrappings, strippable coatings, or other means. After construction of project is complete, remove protective paper or strippable coating and clean exposed surfaces. Surfaces which are damaged, stained, discolored, abraded etc., shall be rejected and replaced with new materials, at no cost to the City of New York.

2.5 STEEL FRAMING, BRACING, SUPPORTS AND REINFORCEMENTS

A. Steel framing, plate reinforcing, supplementary steel framing or reinforcing, bracket assemblies, and the like required for the support, framing, reinforcing, bracing, etc., of work of this Section shall be of such sizes and shapes as indicated on the drawings, or as required to suit the conditions, and shall be provided with all necessary supports and accessory items such as inserts, hangers, braces, struts, clip angles, anchors, bolts, nuts,

welds, etc., as required to properly and rigidly fasten, anchor or attach work of this Section in place and to the concrete, masonry and other connecting and adjoining work.

2.6 HANDRAILS AND RAILINGS

A. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces. Any surface de-coloration to be chemically removed.

5. Form changes in direction of railing members by radius bends.

6. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of handrail and railing components.

7. Provide wall returns at ends of wall-mounted handrails, close ends of returns.

8. Close exposed ends of handrail and railing members with prefabricated end fittings.

9. Brackets, Flanges, Fittings, and Anchors: Provide brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

   a. Furnish inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.
   b. For railing posts set in concrete, provide preset sleeves of steel, not less than 6 inches long and inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

2.7 ORNAMENTAL GRILLES

A. General: Fabricate ornamental grilles to designs indicated from bars and shapes of sizes and profiles indicated. Form bars by bending, forging, coping, mitering, and welding.

B. Form simple and compound curves by bending members in jigs to produce uniform curvature of radii indicated for each configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of components.

C. Welding: Interconnect grille members with full-length, full-penetration welds, unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces. Any surface de-coloration to be chemically removed.

D. Brackets, Fittings, and Anchors: Provide wall brackets, fittings, and anchors to connect ornamental window grilles to other work, unless otherwise indicated.

1. Furnish inserts and other anchorage devices to connect ornamental grilles to concrete and masonry work. Coordinate anchorage devices with supporting structure.

2.8 ORNAMENTAL PERFORATED GRILLES

A. Fabricate ornamental grilles from perforated stainless sheet or plate of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.

B. Drill and countersink grilles for oval-head mounting screws at 2 inches from corners and at 10 inches or less o.c. Provide units with brass oval-head wood screws.

2.9 ORNAMENTAL METAL ENCLOSURES

A. General: Provide sheet metal selected for surface flatness, smoothness, and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials with pitting, seam marks, roller marks, variations in flatness exceeding those permitted by referenced standards for stretcher leveled metal sheet, stains, discoloration, or other imperfections.

B. Coordinate dimensions and attachment methods of sheet metal fabrications with those of adjoining products and construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned with one another in the relationship indicated.

C. Increase metal thickness or reinforce metal with concealed stiffeners, backing materials, or both, as required to produce surfaces whose variations in flatness do not exceed those permitted by referenced standards for stretcher leveled metal sheet and to impart sufficient strength for indicated use.

1. Support joints with concealed stiffeners as required to hold exposed faces of adjoining sheets in flush alignment.

2. Fill space between stiffeners with sound deadening insulation attached to face sheet with cold applied asphalt mastic, unless otherwise indicated.

D. Assemble sheet metal fabrications in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

E. Form sheet metal fabrications to profiles indicated in maximum lengths to minimize joints and without exposed cut edges. Fold back exposed ends of unsupported sheet metal to form a 1/2" wide hem on the concealed side, or ease exposed edges with backing to a radius of approximately 1/32". Produce flat, flush surfaces without cracking or grain separation at bends.

F. Continuously weld joints and seams, except where other methods of joining are indicated. Grind, fill, and dress welds to produce smooth flush exposed surfaces in which welds are not visible after final finishing is completed.

G. Build in straps, plates, and brackets as required for supporting and anchoring fabricated items to adjoining construction. Reinforce sheet metal units as required to attach and support other construction.

H. Where noted, shop perforate enclosure following perforation pattern shown on drawings. Roll, press and grind perforated metal to flatten and to remove burrs and deformations.

I. Conceal fasteners unless otherwise noted on drawings. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.

J. Miter or cope trim members at corners to form tight joints.

2.10 STAINLESS STEEL FRAMING

A. Fabricate frames from stainless steel tubes to the sizes and shapes indicated. Miter and weld frame members at corners. Secure perforated plate in frames with fully continuous welds; all welds shall be ground smooth and flush. Any surface de-coloration to be chemically removed.

B. Refer to Section 088000 for glass set in frame assemblies.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where ornamental metal work is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. General: Install work of this Section square, plumb, straight, true to line or radius, accurately fitted and located, with flush, tight hairline joints (except as otherwise

indicated or to allow for thermal movement), with provisions for other trades, with provisions to allow for thermal movement, with provisions to exclude water where exposed to weather, and with attachment devices as required for secure and rigid installation. It is the responsibility of the Contractor to assure himself that shop fabricated architectural metal items will properly fit the field condition. In cases where the shop fabricated architectural metal items do not fit the field condition, the item shall be returned to the shop for correction.

B. Attachments

1. Unless otherwise indicated, work to be built into concrete or masonry shall be anchored with shop welded on galvanized steel strap anchors; work to be attached to concrete or masonry shall be anchored by bolts into embedded inserts or expansion shields; work attached to structural steel shall be anchored by welds or bolts; work attached to metals other than structural steel shall be anchored by bolts or screws. Power actuated fasteners not permitted unless approved by Commissioner. Provide all supplementary parts necessary to complete each item of work of this Section.

2. All attachment devices shall be of type, size and spacing to suit condition and as approved by Commissioner. Provide shims, slotted holes, or other means necessary for leveling, plumbing and other required adjustments. Attachment devices for work exposed to view shall be concealed, unless indicated otherwise. Where bolts or screws are permitted in work exposed to view, they shall be sized as required with a flat head and counter sunk, unless otherwise noted, with projecting end cut off flush with nuts or adjacent material, and shall match adjacent surfaces.

3. Do all necessary drilling, tapping, cutting or other preparations of surrounding construction in the field accurately, neatly and as necessary for the attachment and support of work of this Section, but obtain Commissioner's approval prior to such preparation to work of others.

C. Tolerances: All work of this Section shall be plumb, square, level, true to radius and correctly aligned within the following limitations:

1. Offset from true horizontal, vertical and design location shall not exceed 1/16" per ten (10) feet of length for any component, not cumulative.

2. Maximum offset from true alignment between abutting components shall not exceed 1/32".

D. All railings shall be installed to withstand loads as required by prevailing Building Code. All guard rails shall comply with OSHA 1910.

E. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units at Contractor's option.

F. Install concealed gaskets and joint fillers as the work progresses, so as to make the work soundproof or lightproof as required.

G. Restore protective coverings which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

H. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude non-uniform oxidation and discoloration.

I. Field Welding: Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work. Welding to comply with NOMMA Finish #1 standards.

3.3 CLEANING

A. Incipient corrosion of stainless steel surfaces shall be prevented during fabrication, transport, storage, installation and adjacent construction. All stainless steel surfaces, including piping surfaces, shall be protected from direct contact with other metals and metal debris, including that generated through welding activities.

1. Stainless steel and stainless steel welds shall be cleaned with soap and water or other approved means and shall be protected at all times from contamination by any materials, including carbon steel, that shall impair its resistance to corrosion.

2. Approved methods of cutting grinding and handling shall be used to prevent contamination. If air-arc, or carbon-arc cutting is used, additional metal shall be removed by approved mechanical means so as to provide clean, weldable edges. All grinding of stainless steel shall be performed with aluminum oxide or silicon carbide grinding wheels bonded with resin or rubber. Grinding wheels used on carbon steel shall not be used on stainless steel. Remove any trace carbon from manufacturing or installation process using chemical means prior to hand over.

3. Sand, grinding wheels, brushes and other materials used for cleaning stainless steel shall be checked periodically by the Commissioner for contaminants. Cleaning aids found to contain contaminants shall not be used on the work.

4. All stainless steel shall be passivated.

3.4 PROTECTION

A. Protect finishes of ornamental metal from damage during construction period with temporary protective coverings approved by ornamental metal fabricator. Remove protective covering at the time of Substantial Completion.

B. Restore finishes damaged during construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

3.5 STAINLESS STEEL WORK SCHEDULE

A. GR-01: Waterjet cut hot dip galvanized steel profile plate posts, 1-1/2 inches stock hot dip galvanized pipe guardrail, and stainless steel cables, turnbuckles, bolts and related hardware and accessories required for complete system.

1. Sizes: As shown on Drawings.

2. Finish: Satin #4 Brushed Finish as per approved samples

3. Stainless steel tensioning hardware "Wagner Invisiware Swaged Tensioning Hardware and Cable System.

B. FT-01: Fin tube radiator cover, 316 stainless steel grille by Johnson or approved equal.

1. Sizes: As shown on Drawings.

2. Finish: Satin #4 Brushed Finish as per approved samples

C. FT-02: Trench Drain Cover, custom cast iron.

1. Sizes: As shown on Drawings.

2. Finish: Cast iron finish as per approved samples

D. MF-01: Coverplates/Fasteners –316 stainless steel.

1. Sizes: As shown on Drawings.

2. Finish: Satin #4 Brushed Finish as per approved samples

E. Covers and grates for 'Small Trench Drains' and 'Small Round Drains' shall be as shown on the details.

1. Potential suppliers include:

a. Ironsmith, 41701 Corporate Way Ste.3, Palm Desert, CA 92260, 760-776-5077 x116 Contact: Bill Evans
b. Zurn Industries: 1801 Pittsburgh Ave, Erie, PA 16502, 1-855-663-9876
Or Approved Equal

2. Drainage bodies shall be as shown on the details, verified to be compatible with the approved drain covers. Potential suppliers include:

a. Zurn Industries: 1801 Pittsburgh Ave, Erie, PA 16502, 1-855-663-9876
b. J.R. Smith Mfg Co, 2781 Gunter Park Dr. E. Montgomery, AL 36109-1405
Or Approved Equal

END OF SECTION

SECTION 062000

CARPENTRY

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the carpentry work as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Blocking and miscellaneous wood, including plywood subflooring and wall lining for telephone and electric closets.

2. Rough hardware.

3. Installation only of finish hardware.

4. Installation only of doors and hollow metal frames.

1.3 RELATED SECTIONS

A. Architectural woodwork - Section 064023.

B. Roofing - Section 073360.

C. Steel doors and frames - Section 081113.

D. Wood doors - Section 081416.

E. Finish hardware - Section 087100.

1.4 QUALITY ASSURANCE

A. Lumber Standard: Comply with PS 20.

B. Plywood Standard: Comply with PS 1 and American Plywood Assoc. (APA).

C. Shop fabricate carpentry work to the extent feasible and where shop fabrication will result in better workmanship than feasible for on-site fabrication.

D. Grade Marks: Identify lumber and plywood by official grade mark.

1. Lumber: Grade stamp to contain symbol of grading agency certified by Board of Review, American Lumber Standards Committee, mill number or name, grade of lumber, species grouping or combination designation, rules under which graded where applicable, and condition of seasoning at time of manufacture.

    a. S-Dry: Maximum nineteen (19) percent moisture content as per ASTM D 2016.
    b. MC-15 or KD: Maximum of fifteen (15) percent moisture content.

E. Installation of doors, frames and hardware shall conform to the minimum standards of "Installation Guides for Doors and Hardware" of the Door and Hardware Institute.

1.5 SUBMITTALS

A. Pressure Treatment: Include certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.

B. Fire-Retardant Treatment: Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

    a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
    b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
    c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
    d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. For wood products, indication (Y/N) of whether the supplied product(s) are certified by the Forest Stewardship Council (FSC).

7. Documentation that all composite wood and agrifiber products do not contain added urea-formaldehyde.

8. Chain of custody certification to document FSC-certification, if applicable.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Engineered wood, not including salvaged wood, shall contain a minimum of 10% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, medium density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with the Submittal Requirements of this Section.

C. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

D. Rough carpentry materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Detailed Specification 013010, Article 1.06.

E. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.7 PRODUCT HANDLING

A. Deliver carpentry materials to the site ready to use with each piece of lumber clearly marked as to grade, type and mill, and place in an area protected from the elements.

B. Deliver rough hardware in sealed kegs and/or other containers which shall bear labels as to type and kind.

C. Pile lumber for rough usage, when delivered to the site in stacks to insure drainage and with a minimum clearance of six (6) inches above grade. Cover stacks with tarpaulins

or other watertight coverings. Store grounds and similar small sized lumber inside the building as soon as possible after delivery.

D. Do not store seasoned lumber in wet or damp portions of the building.

E. Protect fire retardant treated materials against high humidity and moisture during storage and erection.

F. Remove delivered materials which do not conform to specified grading rules or are otherwise not suitable for installation from the job site and replace with acceptable materials.

G. All items specified in Section 087100 of this specification entitled "Finish Hardware" shall be received, accounted for, stored and applied under this Section.

H. Hardware shall be sorted and stored in space assigned by Contractor and shall be kept at all times under lock and key. The safety and preservation of all items delivered will be the responsibility of the Contractor.

1.8 JOB CONDITIONS

A. Installer must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed, and notify the Contractor in writing of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer and the Commissioner.

B. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Rough Carpentry: Lumber for rough carpentry such as nailers, grounds, blocking and framing shall be Construction Grade, thoroughly seasoned dry No. 1 white fir, ponderosa pine, spruce or hem-fir.

B. Preservative Treatment: Lumber for rough carpentry which is incorporated into the finished structures at the exterior, or at the interior where exposed to damp conditions, shall be pressure-treated lumber complying with the requirements established in the latest AWPA P5 and FS TT-W-571 standards. All lumber shall be seasoned lumber with a maximum moisture content of 19 percent at time of dressing. Water-borne preservative with 0.25 percent retainage shall generally be used, however water-borne preservative with 0.40 percent retainage shall be used for all lumber in direct contact with ground or water. All lumber shall be branded accordingly.

C. Fire Retardant Treatment: All wood designated to be fire-retardant treated shall be pressure-impregnated with a flameproofing complying with the requirements of AWPA

Type A, and with U.L., Inc. requirements for flame spread of 25 or less, with no evidence of significant progressive combustion when tested in accordance with ASTM E 84. Each piece of wood shall bear the U.L., Inc. FRS Label or the U.L., Inc. label indicating complete compliance with the fire hazard classification.

D. Code Conformance: Materials shall conform to the requirements of the National Design Specification for Stress Grade Lumber as recommended by the National Forest Products Association, unless otherwise indicated.

E. Plywood Standards: Plywood shall conform to the requirements of the American Plywood Association.

F. Grading: Each panel of plywood shall be identified with the appropriate DFPA grade mark of the American Plywood Association.

G. Exterior Plywood Uses: Exterior type plywood shall be installed where plywood is used for roof sheathing or decking, or in areas where it may be exposed to moisture.

H. Temporary Protection: Exterior type southern yellow pine plywood, APA Grade C, plugged fir shall be used for temporary protection.

2.2 ACCESSORIES

A. Anchors, connectors, and fastenings, not indicated or specified otherwise, shall be provided and installed and shall be of the type, size and spacing necessary to suit the conditions encountered and as recommended by National Forest Products Association. Sizes, types, and spacing of nails, screws, or bolts for installation of manufactured building materials shall be as recommended by the product manufacturer, unless indicated or specified otherwise.

1. Steel rough hardware exposed to the weather shall be zinc-electroplated unless indicated otherwise. Zinc-electroplated steel bolts, nuts, washers, hangers, and straps, and all other rough hardware embedded in, or in contact with exterior walls or slabs, and located in humid areas, shall be provided and installed, except as indicated otherwise.

2. Rough hardware shall be formed and punched before coating. Common steel wire nails, bright finish, shall be used, unless specified otherwise.

3. Bolt heads and nuts bearing on wood shall be provided with standard steel washers.

2.3 HARDWARE

A. Rough Hardware for Treated Woods and Exterior Use: Hot-dipped galvanized or Type 304 stainless steel.

B. Nails: Common steel wire, untreated for interior work as per ASTM F 1667.

C. Bolts: Standard mild steel, square head machine bolts with square nuts and malleable iron or steel plate washers or carriage bolts with square nuts and cut washers conforming to the following:

1. Bolts: ASTM A 307, Grade A.

2. Nuts: ASTM A 563.

3. Lag Screws and Bolts: ASME B 18.2.1.

D. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2; use stainless steel for treated woods and exterior use.

E. Wood Screws: ASME B 18.6.1.

F. Concrete and Masonry Anchors: Standard expansion-shield self-drilling type concrete anchors where so shown ,or noted on the drawings, or where approved by the Commissioner.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where carpentry is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION OF FINISH HARDWARE

A. All finishing hardware specified in Section 087100 of this specification entitled "Finish Hardware" shall be received, accounted for, stored and applied under this Section.

B. Hardware shall be sorted and stored in space assigned by Contractor and shall be kept at all times under lock and key. The safety and preservation of all items delivered will be the responsibility of the Contractor.

C. Hardware shall be carefully fitted and securely attached, in accordance with these specifications and the instructions of the various manufacturers.

D. Unless otherwise noted, mount hardware units at heights established in Section 081113.

E. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

G. Drill and countersink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

H. Cut and fit threshold and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

I. All keys used shall be construction keys which are to be tagged with fiber discs as approved, clearly labeled with identifying inscriptions and then neatly arranged in a temporary cabinet. All construction keys shall be returned to the City of New York.

J. Adjusting and Cleaning

1. Adjust and check each operating item of hardware and each door, to ensure proper operation and function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

2. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.3 INSTALLATION OF DOORS AND FRAMES

A. Preparation

1. Remove welded-in shipping spreaders installed at factory.

2. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

3. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

B. Installation

1. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

2. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. Install frames in accordance with ANSI 250.11-20001, Recommended Erection Instructions for Steel Frames, unless more stringent requirements are specified herein.
b. At fire-protection-rated openings, install frames according to NFPA 80.
c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
d. Install frames with removable glazing stops located on secure side of opening.
e. Frames set in masonry walls shall have door silencers installed in frames before grouting.
f. Remove temporary braces necessary for installation only after frames have been properly set and secured.
g. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

3. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.

4. Metal-Stud Partitions and In-Place Concrete Construction: Solidly pack mineral-fiber insulation behind frames conforming to the requirements of Section 072100 – "Thermal Insulation."

5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar; refer to Section 042000 - "Unit Masonry" for installation of frames in masonry walls.

6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

7. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

9. Installation Tolerances: Adjust steel door frames for squareness, alignment, twist, and plumb to the tolerance given in HMMA 841 of ANSI/NAAMM, current edition.

10. Steel Doors: Fit hollow metal doors accurately in frames to the tolerances given in HMMA 841 of ANSI/NAAMM, current edition.

    a. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

11. Glazing: Comply with installation requirements in Division 8 Section "Glass and Glazing" and with standard steel door and frame manufacturer's written instructions.

    a. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c., and not more than 2 inches o.c. from each corner.

C. Wood Doors

1. Condition doors to average prevailing humidity in installation area prior to hanging.

2. Install doors in accordance with manufacturer's instructions.

3. Fit door to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

4. Clearances: Install doors to meet clearance requirements specified in Section 081416.

5. Fire-Rated Doors: Install in corresponding fire-rated frames in accordance with the requirements of NFPA No. 80. Provide clearances complying with the limitations of the authority having jurisdiction.

D. Adjustments: Check and readjust operating finish hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and

replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

3.4 BLOCKING AND MISCELLANEOUS WOOD

A. General

1. Erect rough carpentry true to line, levels and dimensions required; squared, aligned, plumbed, and securely fastened in place.

2. Shim where required to true up furring, blocking and the like. Use wood or metal shims only.

3. Do all cutting, fitting, drilling and tapping of other work as required to secure work in place and to perform the work included herein. Do all the cutting and fitting of carpentry work, for the work of other trades as required.

B. Blocking and Miscellaneous Wood

1. Furnish and install all wood grounds, furring, blocking, curbs, bucks, nailers, etc., that may be necessary and required in connection with the carpentry and with the work described for any other trades and including required carpentry for electrical fixtures. All blocking and nailers shall be continuous wherever required, whether or not so indicated.

2. Blocking shall be as required for the proper installation of the finished work and for items in mechanical sections as required. Blocking, edgings, stops, nailing strips, etc., shall be continuous, unless distinctly noted otherwise. Provide blocking as required to install all equipment. Provide blocking and nailers where shown or required to fasten interior sheet metal work.

3. Fastening for wood grounds, furring and blocking shall be of metal and of type and spacing as best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts or similar fastenings shall be used, of suitable type and size to draw the members into place and securely hold same.

C. Rough Lumber for Roofing and Sheet Metal

1. Furnish and install all wood nailing strips and wood blocking required in connection with respective types of roofing, fans, flashings, and sheet metal work, using preservative treated wood as herein before specified.

2. Wood blocking shall be of sizes and shapes as indicated on the drawings and/or designed for the reception of curb flashings for roof ventilators and similar items.

3. All nailing strips and blocking shall be carried out in accordance with the printed installation instructions, and/or recommendations of the accepted manufacturer of the roofing materials, and in coordination and cooperation with the sheet metal work trades.

4. All blocking and nailing strips shall be firmly secured in place using counter bored bolt and nut fastenings, or secured by any other proposed flush surfaced fastenings.

5. Wood nailing strips or blocking required to be embedded in concrete work shall be furnished in time due for placing, prior to start of concrete operations. Locations and spacings of nailing strips or blocking shall be performed in coordination with the concrete trades, as required for respective installations.

3.5 TELEPHONE AND ELECTRIC EQUIPMENT MOUNTING BOARDS

A. Furnish and install 3/4" thick plywood panels to the walls of the telephone and electric equipment rooms in accordance with the requirements of the local utility company.

B. Secure to wall using proper devices for substrates encountered, spaced twelve (12) inches o.c., maximum around the edges, 1-1/2" from corners, and in three (3) rows of three (3) each in the field. Recess fastening devices flush with the plywood surface. Adjacent panels shall be butted with 1/16" space between without lapping.

3.6 ROUGH HARDWARE

A. Securely fasten rough carpentry together. Nail, spike, lag screw or bolt as required by conditions encountered in the field and the Contract Documents.

B. Provide rough or framing hardware, such as nails, screws, bolts, anchors, hangers, clips, inserts, miscellaneous fastenings, and similar items of the best quality and of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner.

C. Secure rough carpentry to masonry with countersunk bolts in expansion sleeves or other acceptable manner, with fastenings not more than sixteen (16) inches apart. Secure woodwork to hollow masonry with toggle bolts spaced not more than sixteen (16) inches apart.

D. Countersink bolts in nailers and other rough woodwork and include washers and nuts. Cut bolts off flush with surfaces and peen as may be required to receive finished work.

E. Inserts to secure wood nailers to concrete shall be malleable iron threaded inserts with 3/8" diameter bolts of length to allow for countersinking. Locate at end of each nailer and at intervals not exceeding thirty (30) inches o.c.

F. Furnish to the mason for building into the work, or attaching the work which is to be built in, anchors, bolts, wall plates bolted to masonry, corrugated wall plugs, nailing blocks, etc., which are required for the proper fastening and installation for the work or other items as called for in this Section.

G. Detailed instructions with sketches of necessary requirements, shall be given to the masonry trade showing the location and other details of such nailing devices.

3.7 CLEANING UP

A. General: Keep the premises in a neat, safe and orderly condition at all times during execution of this portion of the work, free from accumulation of sawdust, cut-ends and debris.

B. Sweeping

1. At the end of each working day, or more often if necessary, thoroughly sweep all surfaces where refuse from this portion of the work has settled.

2. Remove the refuse to the area of the job site set aside for its storage.

3. Upon completion of this portion of the work, thoroughly broom clean all surfaces.

END OF SECTION

SECTION 063000

WOOD BENCHES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Wood Benches

1.3 RELATED SECTIONS

A. Sustainability Requirements - Section 013010

B. Concrete Paving - Section 321313

1.4 DEFINITIONS

A. Timber: Lumber of 10 inches by 6 inches nominal.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. ALSC: American Lumber Standard Committee, Inc.
2. NeLMA: Northeastern Lumber Manufacturers' Association.
3. NLGA: National Lumber Grades Authority.
4. ALSC: American National Lumber Grades Authority.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association

1.5 SUBMITTALS

A. Product Data

1. Product Data: Include manufacturing details, material descriptions, dimensions of components and structures and profiles, and finishes for standard manufactured products and components.

a. Wood Bench
b. Wood Plugs
c. Wood Sealant

B. Samples

1. 12" length of full dimension wood edge with eased edges (long edges) illustrating wood grain, color, and general appearance - no sealant
2. 12" length of full dimension wood edge with eased edges (long edges) illustrating wood grain, color, and general appearance – with sealant for comparison
3. Wood plug(s) of same material as wood edge and diameter as indicated in drawings.
4. Provide sample of installed wood plug into wood substrate as a standard of workmanship.

C. Material Certificates

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.

2. For wood sealant/preservative products; Indicate type used and net amount retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

D. Qualification Data: For Fabricator and Installer

E. Certification of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

F. LEED Submittal Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and materials-only cost.

   b. The percentages (by weight) of post-consumer and /or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufacturered.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g. recycled content, VOC content).

3. For products and materials in LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed on the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

5. For wood products, indication (Y/N) of whether the supplied product(s) are certified by the Forest Stewardship Council (FSC).

6. Documentation that all composite wood and agrifiber products do not contain added urea-formaldehyde.

7. Chain of custody certification to document FSC-certification, if applicable.

1.6 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: An experienced installer who has installed projects similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. All lumber must be obtained from one source throughout term of contract.

C. Mock-up: Construct wood bench mock-up with sealant on site as directed by the Commissioner.

1. Notify Commissioner 48 hours in advance of dates and times when mock-up will be constructed.

2. Obtain written approval of mock-up by Commissioner prior to start of construction of remaining wood edges

3. Maintain mock-up during construction in an undisturbed condition as a standard for judging completed Work.

4. Approved mock-up shall become part of complete Work if undisturbed at substantial completion.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Concrete shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 LEED Requirements Section.

1.8 PRODUCT HANDLING, DELIVERY, AND STORAGE

A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review

B. Lumber fabricated from old growth timber is not permitted.

C. Dimensional Lumber

1. Factory mark each item with grade stamp of grading agency.

2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.

4. Provide dressed lumber, S4S, (surface four sides) unless otherwise indicated.

2.2 WOOD FOR BENCHES

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

B. Dimensional Lumber Species: Eastern White Cedar

C. Grade: #1

D. Maximum Moisture Content: 19 Percent

E. Size: 10 inches by 6 inches, nominal, overall lengths as indicated on drawings.

F. Suppliers

1. Kerber Farms & Mill Lumber Co.
3489 Coolidge Highway
Guilford, VT 05301
Ph: (802) 451-6920
www.kerberlumber.com

2. Condon Lumber
250 Ferris Avenue
White Plains, NY
Ph: (914) 946-411
www.condonlumber.net

3. Main Timber Works
823 Augusta Road

Rome, Maine 04963
Ph: (207) 397-2048
www.mainetimberworks.com

4. Or Approved Equal

2.3 WOOD PLUGS

A. Eastern White Cedar from same supplier as wood bench timber.

B. Minimize overall diameter – shall not be larger than 1" diameter.

2.4 WOOD PRESERVATIVE TREATMENT

A. Wood Preservative Treatment: Not Permitted

2.5 WOOD SEALANT

A. Manufacturers:

1. Product: Penofin Marine Oil Finish
Tel: 1-800-PENOFIN, www.penofin.com

2. Product: Watco Teak Oil
Tel: 1-877-385-8155, www.rustoleum.com

3. Product: TWP-100 Series Total Wood Preservative
Amteco, Inc. 1-800-969-4800, www.twp-stain.com

4. Product: Armstrong's Transparent Wood Stain
Amteco, Inc. 1-266-856-3325, www.armstrongclarkstain.com

B. Commissioner to approve wood sample with sealant prior to use on all wood benches.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION, GENERAL

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; drill, trim, scribe and cope as needed for accurate fit.

B. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

C. Securely attach wood edge to substrate by anchoring and fastening as indicated on drawings.

D. Install fasteners without splitting wood; countersink dowels heads, washers and nuts as indicated.

E. Fit components by cutting and restoring exposed surfaces to match specified surfacing. Pre-drill holes for fasteners and assembly of units. Minimize field-cutting.

F. For exposed work, arrange fasteners in straight rows parallel with edges of members, with anchors evenly spaced, as indicated on the drawings.

3.4 WOOD BENCH INSTALLATION

A. Edges: Secure wood edges with threaded stainless steel dowels, washers and nuts, countersunk below finished surface of wood edge.

B. Wood Plug: Orient wood grain of plug in the same orientation as the wood edger. Install and glue white cedar wood plug to match wood edge over countersunk dowel and nut. Plug shall fit snugly within hole, and surface shall have only the wood plug and adjacent wood surface (no visible glue and no other materials). Trim plug to finished surface of wood edge.

C. Anchor Dowels: Threaded galvanized steel set into concrete footing below. Cut anchor dowel to length, not less than ½" and not more than 1" below finish surface of wood edge.

END OF SECTION

SECTION 064023

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the architectural woodwork as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Finish carpentry.
2. Custom casework.
3. Composite surfacing for vanity countertops.
4. Wood trim, moldings, base, and frames.
5. Hardware for casework.
6. Wood shelving.
7. Wood framing and rough lumber as required for work of this Section.
8. Wood grounds, blocking, nailers, furring as required for work of this Section.
9. All rough hardware and fastenings for work of this Section.
10. Drilling concrete and masonry, drilling and/or tapping metal work, as required, for the installation of work of this Section.
11. Back painting as specified herein.
12. Shop finish of work of this Section, except items indicated herein to be shop primed only.

1.3 RELATED SECTIONS

A. Carpentry - Section 062000.

B. Caulking between architectural woodwork and any wall, floor, or ceiling joints - Section 079200.

C. Wood doors - Section 081416.

D. Field finishing - Section 099000.

1.4 QUALITY STANDARDS

A. The quality standards of the Architectural Woodwork Institute, "Architectural Woodwork Standards," 1st Edition, dated October 1, 2009, shall apply to all workmanship including materials and installation, for architectural woodwork and by reference are made a part of this specification. All work shall conform to "Premium" grade requirements of the AWI "Architectural Woodwork Standards," unless otherwise modified herein.

B. In the event of a dispute as to the quality grade (or grades), the Contractor shall call upon the Architectural Woodwork Institute for an inspection under AWI's Quality Certification Program which shall include a QCP Inspection and Report. The Contractor agrees to abide by the decision of this Report.. The cost of said inspection and report shall be borne by the Contractor.

C. Employ only tradesmen experienced in the fabrication and installation of architectural woodwork.

D. Mock-Ups: Provide mock- ups as indicated on Contract Drawings, including but not limited to;

1. WD-03 wood veneer ceiling panels – Four adjoining panels including sub framing

2. WD-06 mullion (2 feet by 2 feet, with CW-01 and GL-02 showing patch connection between mullion and glazing).

3. WD-03, WD-08 Millwork Mockup Showing Corner of Millwork Pod.

4. Prepare a mock-up at the Site, including all components shown on approved Working Drawings, indicating the final relationship and configurations of the various parts and components and the quality of workmanship that shall be achieved in the work.

a. Build mock-up full height and width of opening, at location as indicated on Contract Drawings, and part of an area to receive the work of this Section.
b. Build mock-up of adequate length to include all items that are part of the wood veneer panel system including anchorages and sealant system.
c. Incorporate materials and methods of fabrication and installation that are identical with Project requirements. Accepted mock-up may be incorporated into the finished work.
d. Build as many mock-ups as required to obtain Engineer's acceptance. Disassemble rejected mock-ups and remove all components from Site. Do not incorporate rejected mock-up components into the work.
e. Wood veneer panel installation that proceeds without an approved mock-up shall be stopped, and a mock-up prepared for Engineer's approval.

E. Visual Inspection of Fabrication and Installation of Materials and Systems: Prior to installing Work of this Section, construct each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Provide installation for visual inspection in location as indicated on the Drawings for approval by Engineer for compliance with project design and quality requirements prior to commencement of additional work on specified system or component. The Engineer reserves the right to request rectification of work deemed unsatisfactory.

2. Notify the Engineer 7 days in advance of dates and times when installation will be constructed.

3. Make necessary adjustments in installation, as determined by Engineer's review, and secure Engineer's acceptance.

4. Maintain accepted installation of systems and components during construction in undisturbed condition as standard for judging completed Work.

5. Accepted sample installations in undisturbed condition at time of Substantial Completion may become part of completed Work.

6. Installation shall include the following elements: CW-01 (curtain wall), GF-01 (GFRC eave), WD-01 (wood veneer panel 1), WD-02 (wood veneer panel 2) and WD-06 (wood mullion). Provide installation for 'visual inspection' for all components concurrently, in location as shown on Architectural Contract Drawings.

1.5 SUBMITTALS

A. Shop Drawings

1. Submit shop drawings of all woodwork specified and indicated on the drawings. Shop drawings shall indicate room plans and elevations at 3/4" equals 1'-0" scale and typical construction details at 3" equals 1'-0" scale. Shop drawings shall indicate all materials, thicknesses and finishes.

2. Shop drawings shall show all finish hardware, anchors, fastenings and accessories.

3. Shop drawings shall show all jointing, joint treatment and butt jointing in veneers and plastic laminate.

4. Shop drawings for wood paneling must show complete elevations of rooms to receive paneling as well as panel matching required by these specifications.

5. Shop drawings for cabinet work must show centerline height and horizontal location of all required internal wall blocking.

6. Where architectural woodwork deviates from AWI standards noted herein, shop drawings must identify these deviations.

B. Samples: Submit samples of each of the following items:

1. Samples of all finished woodwork, including wood-polymer lumber, 100 percent recycled HDPE or commingled equal plastic lumber, bio-composite material, and plastic laminate, shall be submitted for color selection and approval.

   a. Size: 12 inches by 12 inches

2. Plastic laminate, twelve (12) inches square, including a section of outside corner.

3. Transparent finish for each species of wood veneer laminated to particleboard, twelve (12) inches square, for each finish specified or shown.

4. Opaque finish wood veneer laminated to particleboard, twelve (12) inches square for each color, gloss and finish specified or shown.

5. Each finish type of wood panel, 24" wide x 36" high.

6. Each type and finish of each type of wood trim, base, etc., eight (8) inches long, finish as specified.

7. Cabinet hardware.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. For wood products, indication (Y/N) of whether the supplied product(s) are certified by the Forest Stewardship Council (FSC).

7. Documentation that all composite wood and agrifiber products do not contain added urea-formaldehyde.

8. Chain of custody certification to document FSC-certification, if applicable.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Engineered wood, not including salvaged wood, shall contain a minimum of 10% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. All composite wood, engineered wood, or agrifiber products (e.g., plywood, particleboard, medium density fiberboard) shall contain no added urea-formaldehyde resins. Acceptable resins and binders include, but are not limited to, phenol formaldehyde and methyl diisocyanate (MDI). Certification of these products shall be in accordance with the Submittal Requirements of this Section.

C. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

D. Composite surfacing shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Detailed Specification 01301, Article 1.06.

E. Finish carpentry materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Detailed Specification 01301, Article 1.06.

F. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.7 QUALIFICATIONS

A. Installer Qualifications: The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

B. Manufacturer Qualifications: The manufacturer providing the material or equipment specified in this section must, for the past five (5) years, have been regularly engaged in the manufacture of material or equipment similar in type to that required for this Project. Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years.

1.8 COORDINATION

A. Coordinate the work of this Section with other appropriate Sections of the specifications to insure proper scheduling for fabrication and installation of the work specified herein

B. Coordinate with partition and finish trades to insure that proper provisions are made for the installation of the work specified herein.

C. Verify all dimensions in the field prior to fabrication of all Architectural Woodwork to assure proper fit.

1.9 PRODUCT HANDLING

A. All materials and work of this Section shall be protected from damage, from time of shipment from shop to final acceptance of work. Cover, ventilate, and protect work of this Section from damage caused by weather, moisture, heat, staining, dirt, abrasions, any other causes which may adversely affect appearance or use, or which may cause deterioration of finish, warping, distortion, twisting, opening of joints and seams, delamination, loosening, etc., of work of this Section.

B. Keep all finish carpentry, millwork, and cabinet work under cover both in transit and at the premises. Do not deliver any finish carpentry, millwork or cabinet work before it is required for installation. Protect such work to avoid damage in transit, during erection and after erection until acceptance of the building; use all such methods to provide the proper protection. Remove such protection when directed by the Architect.

C. Deliver finish carpentry, millwork, and cabinet work in a dry stable condition; protect same against injury and dampness. Do not store or install finish carpentry, millwork or cabinet work until after the concrete, masonry and plaster work are thoroughly dry.

D. Damaged or defective items of work of this Section are subject to rejection and replacement with new by Contractor, at no cost to Owner.

1.10 JOB CONDITIONS

A. Humidity Controls: The ambient relative humidity at the site, including both the storage and the installation areas, shall be maintained between 25% and 55% prior to delivery and through the life of the installation.

B. Determine equilibrium moisture content and maintain required temperature and relative humidity as required for a tolerance of plus or minus one (1) percent of the specified optimum moisture content until woodwork receives specified finishes. Refer to "Guide to Wood Species Selection," AWI, for method of determining equilibrium moisture content values.

C. Examination of Substrate and Conditions: The installer must examine the substrate and the conditions under which the work of this Section is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with work under this Section until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

D. Areas to receive architectural woodwork must be fully enclosed with windows and/or curtain wall installed and glazed, exterior door in place, HVAC systems operational and temporary openings closed. Any plaster, wet grinding and concrete work shall be fully dry.

E. Architectural woodwork shall be allowed to come to equilibrium on site for 7 days prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. WD-03: Wood Veneer Ceiling Panel System

1. Location: Interior Ceiling in Multipurpose Room and Café

2. Manufacturer: Woodtrends, Artexture, Eastern Millwork or approved Equal

3. Product: Select Wood Ceilings with square custom edge, prefinished, 0.6mm Steamed Sand Ash veneer, 1/8" joint. Veneer applied to edges of panels where exposed to view.

4. Substrate: 3/4" thick substrate of Class A fire-retardant Expanded Honeycomb Core or approved equal.

5. Finish: Matte Finish

6. Framing: Woodtrends, Artexture, Eastern Millwork system or approved equal suspended from NYC Department of Buildings approved black iron system.

B. WD-06: Curtain Wall Wood Mullion

1. Solid sealed IPE Mullion Cover, Sunshading Louver

2. Solid IPE Wood by Eastern Millwork or Approved Equal

C. WD-08: Walnut Wood Batten, 2 inches by 4 inches, mill finish American Walnut. Length and fixing as shown on Contract Drawings.

D. WD-09: Wood Wall Base, 5/8 inch by 4 inches, Walnut stained oak or painted as indicated on contract drawings

E. WD-10: Wood Veneer Panel, Eastern Millwork American Walnut Quarter Cut Veneer or approved equal.

F. WD-11: Wood Flooring, Carlisle Wide Plank Floors or approved equal, Stained White Oak (4 Parts Country Pine -GF, 2 parts shaker maple-GF, 1 Part Walnut-GF, Clear Extra Matte Finish)

G. PL-01: Plastic Laminate – Formica Solid Colors Citadel 1097-58 (or equal)

H. PL-02: Plastic Laminate - Formica Solid Colors Dover White 7197-58 (or equal)

I. RS-01, Composite Surfacing: Provide vanity countertops of 99.5% inorganic construction made from recycled glass and concrete, as manufactured by IceStone LLC, Brooklyn, NY, or approved equal.

1. Size and Configuration: As shown on Drawings.

2. Finish: Alpine White

3. Anchors and Fastening Devices: Fabricate from AISI Type 304 stainless steel, No 4 finish.

4. Sealer: Seal composite surfacing surfaces with manufacturer's approved sealer.

2.2 BASIC REQUIREMENTS

A. Wood Moisture Content: Provide kiln-dried (KD) lumber with an average moisture content range of nine (9) to twelve (12) percent for exterior work and six (6) to eleven (11) percent for interior work.

B. Measurements: Before proceeding with woodwork required to be fitted to other construction, obtain field measurements and verify all dimensions of shop drawing details as required for accurate fit.

C. Compatibility of Grain and Color: Architect reserves the right to select materials for best compatibility between visually related members and veneers.

D. Machine and sand woodwork to comply with requirements of Standards for specified grade.

E. Fabricate woodwork to dimensions, profiles and details shown. Rout or groove back of flat trim members, kerf backs of other wide flat members except plywood or veneered members.

F. Miter joints by joining, splining and gluing to comply with requirements for the specified grade.

G. Inspect each piece of lumber and plywood or each unit of woodwork after drying; do not use twisted, warped, bowed of otherwise damaged or defective wood.

2.3 GENERAL - MATERIALS

A. Softwood lumber shall conform to the requirements of the latest edition of American Lumber Standards Simplified Practice Recommendation R-16. Grades shall conform to the grading rules of the Association having jurisdiction, and shall bear the official grade and trademark of the Inspection Bureau of the Association and a mark of mill identification.

B. Framing and Rough Lumber: No. 1 KD grade Southern Pine or Dense Construction grade Douglas Fir, having extreme fiber in bending stress of at least 1700 psi, surfaced four sides (S4S). Provide fire retardant treatment meeting requirements of Section 062000.

C. Grounds, Blocking, Nailers, Furring: Southern Pine, Douglas Fir or Sitka Spruce, grade to suit particular purpose and to be straight, square edged, straight grained, surfaced four sides (S4S), and which will retain nails and screws without splitting. Provide fire retardant treatment.

D. Lumber: AWI Section 3 with the following requirements:

1. Hardwood for Transparent Finish: Premium Grade, select species per finish schedule matching adjoining veneers unless otherwise shown or specified, and free from cat's eyes, bird's eyes, burls, curls or cross grains.

2. Hardwood for Opaque Finish: Any hardwood which, when finished, will not show any grain, imperfection or other surface defects when used with the opaque finish specified.

E. Plywood: AWI Section 4; Veneer core, particleboard, or plywood core unless otherwise specified, and with the following requirements:

1. Hardwood: Premium Grade, face veneers as shown or specified

2. Particleboard: Premium Grade, fire retardant for wall paneling only equal to Duraflake FR and Duraflake for cabinets. In addition, particleboard and MDF shall be certified to the following EPP CPA 3-08 formaldehyde emission limits:

   a. Particleboard meets 0.18 ppm.
   b. MDF meets 0.21 ppm.

3. Edges: Banded with hardwood in accordance with Premium Grade Standards.

F. Veneers

1. Face Veneers for Transparent Finish: AWI, Premium Grade of species of Rift Sliced. Veneer must be flitch matched, sequence matched, book matched, end matched and centered balanced.

2. Face Veneers for Opaque Finish: Any closed grain hardwood veneer that, when finished, will not show grain, imperfection or other surface defects when used with the opaque finish specified.

2.4 PLASTIC LAMINATE

A. Face Sheets: NEMA Publication LD3, Grade GP50, Type I, 0.05" thick, as manufactured by Formica, Nevamar, Wilson-Art. Color, pattern and finish as selected by the Architect.

B. Backing Sheets: Non-decorative, high-pressure plastic laminate, NEMA LD3, Grade BK20, 0.02" thick.

C. Edges: Finish with plastic laminate to match face and applied before face sheets are applied, unless otherwise shown or specified.

2.5 METAL

A. Steel

1. Structural Steel Shapes and Plates: ASTM A 36.

2. Hot-Rolled Carbon Steel Sheets: Commercial quality, ASTM A 569, may be used for concealed parts only. Galvanize sheets for planters.

3. Finishes

a. Primer for Unexposed Metal: Zinc chromate primer.

2.6 COMPOSITE SURFACING

A. Quality and Characteristics: All composite surfacing shall be of best quality, sound stock, and carefully selected; uniform in color, pattern, markings, texture and finish; and free from defects impairing strength, durability or appearance such as cracks, seams, mineral stains, flaws, or imperfections which are not a normal characteristic of the composite surfacing. Patching or filling of chips or cracks is not permitted. Delivered composite surfacing shall match the approved samples, and any composite surfacing not matching the approved sample may be rejected by the Engineer as unfit. Size and thickness of composite surfacing units as indicated on drawings.

2.7 MISCELLANEOUS PRODUCTS

A. Fasteners

1. Wood Screws: FS FF-S-111, type, size, material and finish as required for the condition of use.

2. Nails: FS FF-N-105, type, size, material and finish as required for the condition of use.

3. Anchors: Type, size, material and finish as required for the condition of use.

4. Staples: Upholstery type staples of sufficient strength to hold fabric taut in place without sagging.

B. Adhesives

1. For Laminating Plastic Laminate Surfaces: Urea resin, Type II, as recommended by fabricator.

2. For All Other Uses: polyvinyl acetate resin emulsion or other type as recommended by the fabricator..

2.8 CABINETS WITH PLASTIC LAMINATE FINISH

A. General

1. Fabricate all cabinetry and millwork to the "Premium Grade" standards of the AWI, Section 10.

2. Face construction of cabinets shall be "Flush Overlay."

3. Provide 3/4" thick doors, drawer fronts and fixed panels (including thickness of plastic) except where required to be thicker by Standards; and provide flush units.

4. Provide dust panels of 1/4" thick plywood or tempered hardboard above compartments and drawers, except where located directly below countertops.

5. Exposed Edges: Plastic laminate matching exposed panel surfaces. Ease exposed edge of overlap sheet.

B. Plastic Laminate

1. Plastic Laminate for Horizontal Surfaces: 0.050" thick, general purpose type (high pressure).

2. Plastic Laminate for External Vertical Surfaces: 0.028" thick, general purpose type (high pressure).

3. Plastic Laminate for Post Forming: 0.042" thick, post forming (high pressure).

4. Plastic Laminate for Cabinet Linings: 0.020" thick, cabinet liner (high pressure).

5. Plastic Laminate for Concealed Panel Backing: 0.020" thick, backer type (high pressure).

6. Plastic Laminate Colors and Patterns: As selected by the Architect from manufacturer's standard satin finish products. Acceptable Manufacturers: Wilson-Art, Nevamar, Formica.

C. Shop Assembly: All work shall be shop assembled. Work that is too large for entrance into the use area shall be fabricated in attachable sections with provisions for reconnection in the using space.

D. Material Thicknesses: See drawings for general materials thicknesses. Minimum thickness of solid lumber for web frames, trim, bases, etc., shall be 3/4". Minimum thickness of plywood and particleboard shall be 3/4".

E. Sizes: See drawings for woodwork sizes required. The manufacturer shall check field dimensions and verify all openings and actual field conditions prior to fabrication of work.

F. Manufacturer is responsible for rigidity and structural stability.

2.9 PLASTIC LAMINATE COUNTERTOPS AND VANITIES

A. Grade: Same as AWI grade required for cabinet work; plastic laminate finish.

B. Construction

1. Provide back-splash and end-splash, where detailed; top-mounted square butt joint, fully covered with matching plastic laminate, eased edges.

2. Exposed Counter Edges: Plastic laminate matching surface, except as otherwise indicated. Ease exposed edges of overlap sheet.

3. Cut openings for equipment to be installed. Comply with equipment manufacturer's requirements, but provide internal corners of 1/8" minimum radius. Smooth saw cut and ease edges.

4. Seal cut edges of counter at openings for sinks and other "wet" equipment, using waterproofing compound recommended by plastic manufacturer and compatible with laminating adhesive.

2.10 BUILT-IN CABINETS, WOODWORK WITH WOOD VENEER FINISH

A. Construction: Details of cabinet and wood work construction shall conform to design as detailed on the drawings and shall be constructed in accordance with AWI Section 10, Premium Grade.

B. Finishing: All work shall be factory pre-finished. No field finishing will be permitted, except minor retouching that is necessary after installation to leave work in perfect condition. Field touch-up shall be accomplished using the same finishes as originally applied at the factory. All finishes shall be free from runs, sags and other visual defects. All wood shall be thoroughly hand smoothed and hand sanded to remove all traces of machine and tool marks. All steel or other metal components shall be deburred, thoroughly cleaned and degreased prior to finishing. Requirements for surface preparation shall be in accordance with AWI Standards specified. Surfaces shall be finished as follows:

1. Wood veneers shall be as specified herein, flitches to be selected by Architect. Veneer shall be minimum 1/28" thick.

2. All wood veneer surfaces shall be given transparent finish as specified herein.

3. Backing Veneer: Provide backing veneer, of same thickness and strength as face veneer for balanced construction, where plywood surface not exposed, not semi-exposed, or not to be finished. Note that interior surface of cabinets, closets, are to be finished.

C. Edge Banding: All visible edges of case and body members fabricated from plywood shall be banded. Transparent finished wood veneer panels shall be banded with wood species to match face veneers.

2.11 CABINET HARDWARE

A. Architectural Woodwork Hardware: Provide the following items, as required:

1. Hinges: Concealed hinges.

2. Catches: Magnetic; top and bottom.

3. Pulls: Selected by the Architect.

4. Locks: Directed by the Architect.

5. Drawer Slides: Full extension, 100 lb. capacity.

6. Shelf Supports: Pin and grommet system.

7. Finish: Satin Stainless Steel.

8. Closet Hardware: Oval wardrobe rails, chrome plated steel with center bracket and wall support brackets.

2.12 WOOD FOR RAILS, CAPS, TRIM, BASES, MOLDINGS AND FRAMES

A. Quality Standard: For the following types of interior architectural woodwork, comply with indicated standards as applicable.

1. Standing and Running Trim: AWI Section 6.

2. Miscellaneous Millwork: AWI Section 6.

3. Stair Handrails: AWI Section 7.

B. Wood Work for Transparent Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Quarter Sawn Species as noted on drawings.

C. Woodwork for Paint Finish: Except as otherwise indicated, comply with the following:

1. Grade: Premium.

2. Species of Solid Wood: Solid, paint grade, sound clear Poplar or Birch.

2.13 HARDWOOD VENEERED PLYWOOD PANELS

A. Type: Interior grade, hot press laminated with waterproof adhesive, pre-finished, with face veneers and core construction as specified herein, meet AWI Section 8 standards.

B. Core Construction: Shall be fire retardant treated, meeting requirements of Section 06200; type at fabricator's option.

1. Where the core is free of urea formaldehyde, provide a layer of veneer over the substrate prior to application of finish veneer to prevent telegraphing of patterns of the adhesive.

C. Thickness: 3/4" thick.

D. Face Veneers: Panels shall be flitch matched, sequence matched, book matched, end matched, center balanced, species per finish schedule, vertical grain, and shall be matched for color. Use this veneer in all other areas where wood paneling is required. All panels sshall be matched one to the other using "blueprint" matching method. Veneer shall be minimum 1/28" thick.

E. Finish: Veneers shall be finely sanded and clear factory pre-finished using AWI System noted herein.

F. Panel Sizes: See drawings for panel sizes required.

G. Exposed edges of panels shall be solid sections matching face veneer.

H. Where wood doors are set in veneered wood paneling, veneer on door shall be sequenced to fit veneer pattern; doors to meet the requirements of Section 081416.

2.14 FABRICATION - GENERAL

A. Provide lumber framing for architectural woodwork, complete with all bracing and fastening devices as required for a rigid installation, and as required to sustain the imposed loads.

B. Do all fabrication from field measurement with provision for scribing as required to meet built-in conditions.

C. Coordinate the work of this Section with the work of other trades.

D. Fabricate units in largest practicable sections. Assemble in the shop for trial fit, disassemble for shipment and reassemble with concealed fasteners.

E. Maintain relative humidity and temperature during fabrication, storage and finishing operations matching that of the areas of installation.

F. Details indicate the required type and quality of construction. Modifications to conform to manufacturer's standards will be considered providing they comply with the Contract Documents, maintain the profiles shown and subject to acceptance by the Architect.

G. Reinforcing shown is minimum. Provide additional reinforcing as required to ensure a rigid assembly. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects affecting serviceability or appearance. Accurately fit all joints, corners and miters. Conceal all fasteners. Make threaded connections up tight so that threads are entirely concealed.

H. Factory finish all items where possible. Defer final touch-up, cleaning and polishing until after delivery and installation.

I. Comply with AWI, Premium Grade standards for sanding, filling countersunk fasteners, back priming and similar preparations for the finishing of architectural woodwork, as applicable to each unit of work.

J. Prepare all countersunk wood screw attachments for wood plugs. Wood plugs shall match surrounding species and grain direction; putty filling is not acceptable.

2.15 FABRICATION - SPECIFIC ITEMS

A. Casework

1. Include all preparations for mechanical, electrical, telephone and plumbing work required.

2. Provide cabinet hardware for casework as shown.

3. Provide dust panels in body webs and between drawer units.

4. Provide wood veneers for exposed surfaces as specified herein before.

5. Hollow core doors will not be permitted.

6. Provide matching veneers for edge treatments of case body members where transparent finishes are indicated or specified.

7. Provide drawers with slides as specified. Drawers shall not rest on web body frames.

8. Provide wood veneers for transparent finish, of matching and continuing grain, for drawer and door edges.

B. Paneling

1. General Paneling Requirements

a. Panel type shall be AWI, Premium Grade construction.
b. Panel joints shall be flush type unless otherwise shown.

c. Provide concealed wood blocking and framing, anchors, clips, splines, supporting and attaching devices.
d. Provide cut-outs to receive attachments, mechanical and electrical work as required.

2. Wood Veneer Paneling

a. Comply with AWI Section 8.
b. Provide veneers as specified and as shown, including all matching requirements. Run veneer in the direction shown.

3. Stile and Rail Paneling

a. Comply with AWI Section 8.
b. All exposed edges of panel cores shall be edge banded.
c. Grain direction shall be as shown.

C. Closet and Storage Shelving

1. Provide closet and storage shelving in accordance with AWI Section 600, Custom Grade, unless otherwise shown or specified.

2. Exposed edges shall have hardwood edge bands.

D. Standing and Running Trim: Provide standing and running trim of the sizes, profiles, species and finish as specified or shown and complying with AWI Section 6, Premium Grade.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where architectural woodwork is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 FRAMING

A. Use specified framing lumber, sizes and spacing as indicated on drawings and as required to support loads.

B. Framing shall be cut square on bearings, closely fitted, accurately set to required lines and levels, rigidly secured in place at bearings and connection with nails, lag screws and/or bolts as required by conditions.

3.3 GROUNDS, BLOCKING, NAILERS AND FURRING

A. Provide all wood grounds, blocking, nailers, furring, and the like for work of this Section, where shown and where required, dressed to size indicated or required to suit

the condition. Install grounds, blocking, nailers, furring, etc., rigidly, in proper alignment, trued with a long straight edge.

3.4 ROUGH HARDWARE

A. Provide all rough hardware, such as nails, screws, bolts, anchors, hangers, clips and similar items. Hardware shall be of the proper size and kind to adequately secure the work together and in place, in a rigid and substantial manner. Use galvanized hardware at exterior walls, and at other locations where subject to moisture or where water will be present.

B. Secure wood to concrete and to solid masonry with countersunk bolts in expansion sleeves or other approved manner, to steel with countersunk bolts, to hollow masonry and to drywall with heavy duty countersunk toggle bolts. Space fastenings not more than sixteen (16) inches apart. Hardened cut nails, power-driven fastenings, or other suitable devices may be used where approved by the Architect.

C. Connections and fastenings shall be made in such manner as will compensate for swelling and shrinkage and shall permit the work to remain permanently in place without any splitting or opening of joints.

3.5 INSTALLATION OF CABINET FINISH HARDWARE

A. All items of finish hardware furnished under this Section shall be carefully fitted and secured in place as part of the work of this Section. Locations and positioning of hardware shall be subject to the Architect's approval. Care shall be taken not to mar or damage hardware, or other work. Install doors plumb and true. Hardware shall be fitted to assure operation without forcing.

B. After preliminary fitting of hardware, the Contractor shall remove trim for painting and finishing work; after which he shall reinstall the hardware in a permanent manner.

C. Upon completion of the work, before final acceptance of the building by the Owner, the Contractor shall, in the presence of the Architect, show that all hardware is in satisfactory working order; fit all keys in their respective locks and, upon acceptance of the work, shall tag and deliver all keys to the Architect and Owner.

D. When directed by the Owner, at any time during the first year after the completion of the Contract, the Contractor shall return to the building and adjust and refit the work and hardware, and leave such items in satisfactory working order.

3.6 GENERAL INSTALLATION

A. Wall anchorage and general installation procedures for cabinetry work shall conform to AWI Section 10, Article entitled "EXECUTION", Sub-Article 6.1 with all related sub-paragraphs.

B. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops), and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offset in revealed adjoining surfaces.

C. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

3.7 TRIM, MOLDINGS, ETC.

A. Install with minimum number of joints possible, using full-length pieces for each run. Stagger joints in adjacent and related members. Cope at returns, miter corner.

B. Joints of all trim and/or moldings shall be set tight, miter exterior angles and cope interior angles. Joints, except end joints less than twelve (12) feet apart, will not be permitted in straight runs of trim and/or moldings and rails.

C. Secure all trim and/or moldings with glue and blind nail with finishing nails. Set exposed nail heads in finished work and putty. Sand all work to remove any tool marks and irregularities.

D. Wood shall receive finish as specified in Section 099000 - Painting.

3.8 VENEERED WOOD PANELS

A. Provide a system of concealed panel hanger clips, shims and corresponding wall clips to support the panel system. Face nailing shall not be permitted.

B. Hang the panels in the designated locations. Panels shall be straight, level, flat and flush with adjoining panels.

C. Where reveals are indicated, keep panels spaced so that reveals are parallel and of widths shown.

3.9 CLOSET AND STORAGE SHELVING

A. Provide closet and storage shelving at the locations shown. Provide hang rods where shown. Set adjustable center hangers.

3.10 CABINET WORK AND MILLWORK

A. General

1. Materials and workmanship shall conform to the Quality Standards of the Architectural Woodwork Institute specified herein and to the drawings.

2. Cabinet work and millwork shall be performed by experienced cabinet work and millwork company, having craftsmen skilled in their trade.

3. Fabricate all cabinet work and millwork completely in the shop, in complete and/or as large units as practical, leaving only fitting, assembly, installation and a minimum of fabrication and finishing to be done at the building. Assembled

work shall be rigidly secured and permanently fastened together with concealed fasteners.

4. Afford Architect every facility for inspection of work at shop or mill at such times as the Architect may select.

5. As far as practicable, use concealed fastenings for joining and assembling the work. Where this is impossible, the means of securing shall be placed in inconspicuous places and methods of joining and assembling submitted for Architect's approval prior to fabrication.

6. Mill all finish wood accurately to detail, with clean cut moldings, profiles and lines, machined, sanded smooth, housed, jointed, blocked, put together in the best manner, with provision for swelling and shrinkage, and to assure the work remaining in place without warping, splitting or opening of joints.

7. Cut trim to dimensions and profiles shown, from solid stock.

8. Make all trim and the like in single lengths wherever possible; joints mitered, glued and splined. Continuous members shall have tight flush joints, doweled or splined and glued.

9. Make all joints hairline tight, fitted accurately and joined with hardwood splines or dowels, glued together, or by other method approved by Architect. Use screws, not nails, for fastenings.

10. Gluing shall, where practicable, be by the hot plate press method and glued surfaces shall be in close contact throughout. Glue stains on finished work will not be permitted.

11. Cover surface fastenings, where permitted, with matching wood plugs or wood putty. Finish exposed edges of plywood with matching solid stock. Lock miter external corners; tongue and groove internal corners to allow for contraction and expansion.

12. Machine sand with grain, finish with hand sanding, leave exposed surfaces free from machine or tool marks that will show through the finish.

13. Work which adjoins drywall, concrete, or other finish shall be fitted and scribed in a careful manner and ample allowance shall be given for cutting and scribing.

14. Erect work true to lines, levels and dimensions, square, aligned and plumb, securely and rigidly fastened in place.

B. Cabinet Work: Provide all items of cabinet work indicated on drawings and as herein specified.

1. Tops, sides, backs, bottoms, dividers, shelves, fronts, doors and drawer fronts shall be of plywood or flakeboard core, with the specified wood veneer or plastic laminate as indicated on drawings.

2. Drawer sides and backs shall be 1/2" thick solid clear selected white birch, suitable for clear finish. Drawer bottom shall be 3/8" thick plywood with clear selected white birch veneers, suitable for clear finish.

3. Cabinet doors and drawers shall be flush mounted.

4. Adjustable shelves in cabinets shall have grommets spaced 2" o.c.

5. Fixed shelves shall be dadoed into side supports and glued.

6. Shelves shall be 3/4" thick for spans up to 30"; for spans in excess of 30" to 48" shelves shall be 1" thick.

7. All cabinets shall have closed top, sides, bottom, and back with veneers to match face work. Cabinets to fit accurately into indicated locations; scribe moldings permitted only where indicated.

8. Countertops, counters, counter fronts, shelves, etc., indicated on drawings to have plastic laminate, shall have plastic laminate shop applied to 3/4" thick core, with plastic laminate backing sheet on underside or back of countertops, counters and shelves. Plastic laminate shall be pressure laminated to core with laminate at external corners. Provide concealed wood framing to support plastic laminate counters, securely fastened to wall and to underside of counters.

C. Countertops shall be installed to support a minimum concentrated live load of 150 lbs. acting downward at mid span at outer edge of counter without causing deformation and damage.

3.11 SETTING COMPOSITE SURFACING COUNTERTOPS

A. Cutouts and Drilling: Provide countertops with cutouts for sinks, faucets, etc. Cutouts shall be carefully made in accordance with templates furnished under the Plumbing Section. Composite surfacing shall be drilled as required to receive anchoring and fastening devices.

B. Setting: Set countertops in required pattern over cabinet work using stainless steel anchors. Counter fascias (if indicated) shall be doweled to countertop. Set countertops and counter fascias level, plumb and square.

C. Joints: Maintain an even joint between units, 1/16" max. Point joints with approved elastic non-staining mastic pointing compound, color to match composite surfacing. Tool joints flush. Clean exposed surfaces carefully.

3.12 WOOD BASES

A. Provide plywood backing, toggle bolted to substrate, if substrate not suitable for securing wood base.

B. Machine wood bases from specified wood, to profiles indicated on drawings.

C. Set base level and plumb. Where indicated on drawings, face of wood base shall be flush with wall above. Glue wood base to substrate or to plywood backing, and screw

or nail wood base to substrate or to plywood backing with countersunk wood screws or with finishing nails, recess wood screw heads, and spackle with wood putty, set and spackle nails with wood putty. Do not nail or fasten wood base to floor. Ends of wood base shall be either splined or ship lapped.

D. Where no wood backing occurs, screw apply base at each stud with screw countersunk and wood putty applied and sanded smooth and flush with base.

3.13 WOOD DOOR FRAMES

A. Where indicated on drawings, provide wood frames and bucks for wood doors. Bucks shall be braced, set straight and plumb and have anchors for building into adjoining construction; space anchors not over two (2) feet apart (one foot from corners). Machine wood frames from specified solid wood to profiles indicated on drawings. Set frames plumb, level, square; securely attached to adjoining construction. Wood frames, bucks and trim shall conform to details.

3.14 PAINTING AND FINISHING

A. General: All painting and finishing work of this Section shall be shop applied, unless otherwise noted, as specified below. All painting and finishing shall match approved samples. Field finish painting, where specified below, shall be by painting Subcontractor, as specified for in Painting Section.

B. Schedule of Painting and Finishing

1. Shop Primer On:

a. Wood bases.
b. Wood trim and moldings to be field finish painted.
c. Ferrous metal work.

2. Shop Natural Finish On:

a. Wood paneling.
b. Wood cabinets with wood veneers.

C. Back-Painting: All work of this Section in contact with concrete or masonry or other moisture areas and all concealed surfaces of cabinet and millwork, shall be back-painted with one (1) coat of oil based paint prior to installation, shop applied where practicable.

D. Field Touch-Up: Field touch-up shall be the responsibility of the installing Subcontractor, and shall include the filling and touch-up of exposed job made nail or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and mars, and final cleaning up of the finished surfaces.

3.15 REPAIR, CLEANING AND SEALING OF COMPOSITE SURFACING

A. Remove and replace composite surfacing units that are broken, chipped, stained, or otherwise damaged. Where directed, remove and replace units that do not match

adjoining composite surfacing work. Patching or hiding chips or cracks in composite surfacing will not be permitted. Provide new matching units, install as specified and reseal joints to eliminate evidence of replacement. Reseal defective and unsatisfactory joints to provide a neat, uniform appearance.

B. Clean and seal composite surfacing work after completion using sealer specified herein and cleaner as recommended by sealer manufacturer; follow manufacturer's instructions.

3.16 CLEAN UP AND PROTECTION

A. Clean Up: At regular intervals during the course of the work, all debris and excess material shall be cleaned up and removed from the site. Upon completion of installation, clean all spaces of debris caused by woodwork installation.

B. Protection: Protect all woodwork from marring, defacement of other damage until final completion and acceptance of the project by the Owner. Repair or replace all defective units prior to final inspection as directed by the Architect. Any units that cannot be satisfactorily repaired in the opinion of the Architect shall be replaced with new units of same original design, at no additional cost to the Owner.

END OF SECTION

SECTION 071326

SHEET MEMBRANE WATERPROOFING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the sheet membrane waterproofing as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Sheet membrane waterproofing at Plaza and Terrace areas.

2. Sheet membrane waterproofing for underslab conditions.

3. Sheet membrane waterproofing, for foundation wall surfaces.

4. Sheet membrane waterproofing for blindside of foundation wall surfaces.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Fluid membrane waterproofing - Section 071413.

C. Earthwork - Section 312000.

1.4 SUBMITTALS

A. Shop Drawings: Typical installation details, showing details at flashings, at terminations, at joints, at intersection of horizontal and vertical surfaces, and at penetrations in membrane system.

B. Samples - Submit

1. Membrane, 6" x 6" samples of each membrane.

2. 6" x 6" sample of flashing.

3. 6" x 6" sample of drainage board.

C. Manufacturer's Literature: Submit manufacturer's technical, safety data sheets, and installation literature for all materials of this Section. Submit Independent Test data indicating that membrane meets properties specified herein.

D. General Contractor's Certification: Submit per Article 1.9.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Sheet membrane waterproofing shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Sheet membrane waterproofing materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing

system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.6 STORAGE OF MATERIALS

A. All materials shall be stored in their original tightly sealed containers or unopened packages; shall be clearly labeled with the manufacturer's name, brand name and number, and batch number of the material with expiration date where appropriate.

B. Materials shall be stored in a neat and safe manner so as not to exceed the allowable live load of the storage area.

C. Material shall be stored out of the weather in a clean, dry area.

D. Liquid materials, such as adhesives, thinners and primers, shall be stored in areas away from sparks, open flames and excessive heat.

1.7 JOB CONDITIONS

A. No application of waterproofing shall commence or proceed during inclement weather, or the threat of imminent precipitation.

B. All surfaces to receive the system shall be thoroughly dry and free of dew or frost.

C. Materials shall be stored until time of mixing at temperatures above 60 deg. F. to maintain a consistency suitable for mixing. Do no work below 40 deg. F.

D. Prior to and during application, all dirt and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air, or similar methods.

E. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.

1.8 WARRANTY

A. The manufacturer of the waterproofing system executed under this Section warrants the waterproofing system to be watertight and free from defects in materials and workmanship for a period of ten (10) years from date of acceptance of this Contract, and that he, at his own expense, repair and/or replace all other work which may be damaged as a result of such defective work, and which becomes defective during the warranty period.

B. Contractor's Two Year Workmanship Warranty: Provide a written guarantee for all work of this Section, stating that if, within two years after the Date of Substantial Completion of the Work, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from the City of New York to do so.

1.9 QUALITY ASSURANCE

A. Preinstallation Conference: Approximately 2 weeks prior to scheduled commencement of waterproofing installation, meet at Project site with Waterproofing Installer; preparer of substrate to receive waterproofing; installers of other work in and around

waterproofing that must precede, follow, or penetrate waterproofing (including Mechanical and Electrical Installers as applicable); Commissioner; City of New York; and waterproofing manufacturer's representative to review materials, procedures, schedules, and other requirements and conditions related to installing waterproofing.

B. Qualifications of Subcontractors

1. Subcontractors: All work of this Section shall be performed by a subcontractor who is properly trained by the manufacturer of the waterproofing material.

2. Qualifications of Subcontractors: Subcontractors shall submit evidence of being bona fide waterproofing subcontractors, for a period of not less than three (3) years, and that they are properly trained by the manufacturer of the waterproofing material for the installation of the manufacturer's material in accordance with the requirements of this Section.

   a. Subcontractor shall submit a letter from manufacturer of waterproofing material stating that subcontractor is properly trained by the manufacturer for the application of the waterproofing systems specified and accepted for use on the Project.
   b. Letter shall certify that the subcontractor has previously and satisfactorily applied the waterproofing systems specified herein on jobs of similar size and scope, under manufacturer's supervision.
   c. Letter shall be on manufacturer's letterhead and shall be signed by an officer of the company, not by a local sales representative.

C. Manufacturer's Representative/Contractor's Certification

1. Representative of the waterproofing material manufacturer shall be required to provide field instructions and supervision for the installation of the waterproofing systems at the start of the work of this Section.

2. The manufacturer's representative shall be required to make sure that the workmen for waterproofing systems on the site of the Project are fully instructed and trained in the handling and application of all the materials, and shall see that all the materials are correctly installed.

3. Upon completion of the Installation, submit to the Commissioner written certification that the representative of the manufacturer of the waterproofing material has supervised the work of this Section and that all materials were correctly installed.

1.10 PROTECTION

A. Against Loads: Protect work of this Section against concentrated loads and any other loads or equipment that would damage the materials or work.

B. Against Traffic: Do not permit traffic on horizontally installed work of this Section, except for workmen doing the work, during the installation, and after the installation until membrane systems are covered with protective boards or with the specified finishing materials.

C. Against Damage: Protect vertically installed work of this section from damage by reinforcing and placement.

1. Take and maintain necessary preventative measures to protect work of this Section from damage until Project is accepted.

2. Rejection of Damaged Work

a. Damaged materials or work will be rejected.
b. Rejected materials or work must be immediately removed and replaced with new materials.

1.11 FIELD QUALITY CONTROL

A. Construction Traffic:

1. Limit construction traffic over completed membrane.

2. General Contractor shall provide 1/2 in. plywood protection layer, where construction traffic is unavoidable.

B. Inform Commissioner in writing on a daily basis of any of the following events. State specific location of each occurrence.

1. Buckling to the Waterproofing and other deformations as a result of ground water events.

2. Leakage through the finished waterproofing installation.

3. Damage by other trades.

C. Provide Manufacturer's Representative's report (prior to backfill) stating that the waterproofing has been inspected and is acceptable and eligible for manufacturer's warranty.

PART 2 PRODUCTS

2.1 WATERPROOFING MEMBRANE

A. Trade names used herein for membrane waterproofing are those of W.R. Grace. Other manufacturers noted herein (Carlisle, Henryt, Polygard) may substitute their equivalent products.

1. Where Colloid Environmental Technologies Co. (CETCO) are noted herein, membranes specified shall also include the following related products as required by Project conditions:

a. Bentoseal: Trowel grade sodium bentonite compound used as a detailing mastic around penetrations, corner transitions and grade terminations.
b. Hydrobar Tubes: 2" diameter x 2' long, water soluble tube container filled with granular sodium bentonite.
c. Waterstoppage: 50 lbs. bag of granular Volclay sodium bentonite.
d. Seam Tape: 2" wide butyl rubber sealant tape.

e. Termination Bar: Minimum 1" wide aluminum bar with pre-punched holes on 12" centering for fastening.
f. Cementitious Wall Board: 1" thick cementitious board for protection of waterproofing during the removal of metal soldier pile cap and top lagging boards.
g. CETSEAL: Single component polyether general adhesive and sealant.
h. TB-Boots: Pre-molded thermoplastic tie back covers.
i. GF-40SA: General flashing membrane used for grade detailing.
j. Aquadrain 15XP: 4' x 52' roll of three dimensional polypropylene drainage core with non-woven geotextile adhered to one side to allow water passage while restricting soil particles. Composite includes a thin polyethylene sheet on the back of the drainage core.
   1). Compressive Strength, 15,000 psf; water flow rate, 20 gpm/ft.
   2). Thickness, 7/16".
k. Aquadrain 100BD Base Drain: 1" thick x 12" high base drain composite designed to collect water from sheet composite drainage and then discharge the water to proper sump system or gravity to daylight.
   1). Compressive Strength, 10,000 psf; water flow rate, 97 gpm/ft.
   2). Thickness, 1".

2. Should the Contractor elect to use CETCO products, he must submit complete specifications, instructions and full detail for Commissioner's review. Installation of CETCO products must be in accordance with manufacturer's data and specifications.

B. For accessible foundation walls and Plaza and Terrace waterproofing, provide "Bituthene 4000" sheet waterproofing membrane, 60 mils thick, and "Bituthene Liquid Membrane," 60 mils thick, for flashing, as manufactured by W. R. Grace or equal made by Carlisle, Polyguard Products, Inc. or the Henry Co.

1. Alternate Acceptable Material: "Ultraseal BT Membrane" as manufactured by Colloid Environmental Technologies Co. (CETCO).

C. At underslab conditions, provide adhesive coated HDPE Composite Sheet "Bituthene Preprufe 300R" system by W. R. Grace & Co. or approved equal noted above.

1. Alternate Acceptable Material: "Ultraseal SP Membrane" as manufactured by Colloid Environmental Technologies Co. (CETCO).

D. At blind side waterproof condition, provide adhesive coated HDPE Composite Sheet "Bituthene Preprufe 160R" system by W. R. Grace & Co. or approved equal noted above.

1. Alternate Acceptable Material: "Ultraseal BT Membrane" as manufactured by Colloid Environmental Technologies Co. (CETCO).

E. HDPE membrane shall have a protective layer to protect the membrane from the weather and U.V. for up to 30 days before casting concrete against it.

F. Primer/Conditioner: "Bituthene 4000" latex/water based primer specifically formulated to provide adhesion of Bituthene Waterproofing Membranes, or approved equal.

1. If water based primer does not provide sufficient adhesion to substrate, substitute Bituthane Primer B-2 solvent based primer, or approved equal.

G. Bituthene Elastomeric Mastic: Rubberized asphalt base mastic.

H. Tape: Double sided synthetic adhesive tape equal to Preprufe "LT" and "HC," or approved equal.

I. Protection Board: 1/4" thick semi-rigid protection board, Bituthene Asphaltic Hardboard, or approved equal.

J. Bituthene Liquid Membrane: Two-component 100% solids trowel grade asphalt modified urethane.

K. Drainage Board/Composite: "Hydroduct 220" by W.R. Grace, or approved equal, prefabricated dimpled polystyrene drainage core with a non-woven filter fabric on one side and a polymer film on the reverse side.

1. At horizontal applications, use Hydroduct 660 by W.R. Grace, or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where membrane waterproofing is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work. Starting of work implies acceptance of substrate.

3.2 PREPARATION OF SURFACES TO RECEIVE WATERPROOFING

A. Conform to the requirements of manufacturer's technical information regarding preparation of surfaces to receive waterproofing.

B. Earth or crushed stone substrates shall be compacted to produce an even, sound substrate. Loose aggregate, sharp protrusions and standing water shall be removed.

3.3 INSTALLATION

A. General: Conform to recommendations and published specifications of the manufacturer' including environmental requirements.

B. Foundation Walls (Accessible Walls)

1. General: The membrane, when in place must withstand a minimum static ground water pressure of 150 feet.

2. Priming: Application of primer shall be limited to what can be covered with Bituthene Waterproofing Membrane in a given work day. Primed areas not covered by membrane during the work day will be reprimed. Apply primer by spray, roller or brush at a rate of 250 - 350 sq. ft. per gallon. Roller shall be natural material such as lamb's wool, having a nap of approximately one inch. Primer shall be applied to a clean, dry, frost-free and dust-free surface. Sufficient

primer must be used on the day surface to condition it to a dust-free state suitable for the application of Bituthene Waterproofing Membranes.

a. Bituthene 4000 Surface Conditioner should not be applied below 40 deg. F. on vertical surfaces. Allow primer to dry 30 minutes. Conditioner is considered dry when the substrate returns to its original color.
b. Re-prime areas that become dusty or dirty prior to membrane installation.

3. Membrane Installation: Apply Bituthene Waterproofing Membrane vertically in sections of 8' in length or less. On higher walls apply two or more sections with the upper overlapping the lower by a least 2-1/2". Press all membrane in place with heavy hand pressure or rollers during application.

4. Sealing Edges: Bituthene Waterproofing Membrane shall be applied over the edge of the slab or over the top of the foundation or parapet wall. If the membranes are terminated on the vertical surface, a reglet or counter flashing may be used or the membrane may be terminated directly on the vertical surface by pressing very firmly to the wall. Press edges with a metal or hardwood tool such as a hammer or knife handle. Apply a troweled bead of Bituthene Mastic to all vertical and horizontal terminations. Bituthene Liquid Membrane can be used as an alternative method at the General Contractor's option.

5. Sealing Seams: All edges and end seams must be overlapped at least 2-1/2". Apply succeeding sheets with a minimum 2-1/2" overlap and stagger end laps. Roll or press the entire membrane firmly and completely as soon as possible. Patch misaligned or inadequately lapped seams with Bituthene Membrane. Slit any fish mouths, overlap the flaps, and repair with a patch of Bituthene and press or roll in place. The edges of the patch shall be sealed with a troweling of mastic. Laps within 12" of all corners shall be sealed with a troweling of mastic.

6. Corner Forming: Outside corners must be free of sharp edges. Inside corners shall receive a fillet formed with Liquid Membrane, latex modified cement mortar equal to Daraweld C made by Grace mixed with cement mortar or epoxy mortar. Do not use fiber or wood cants. One of two methods may be used for treating corners at the General Contractor's option:

a. Apply Bituthene Liquid Membrane 6" in each direction from the corner and form a fillet with a minimum 3/4" face.
b. Install an 11" minimum strip of Bituthene Membrane centered on the corner. Install Bituthene Membrane over the treated inside and outside corners.

7. Over waterproofing, apply drainage composite board by adhering board to cured membrane using tape or adhesive per manufacturer's recommendations; lap all edges 4" and conform to the following:

a. Install drainage layer directly over the membrane. Start at the low points on the wall and shingle all laps to the flow of water.
b. Splice drainage panels together by butting longitudinal edges of adjacent sheets and peeling back fabric to expose the cores of the panels. Install precut "lock strips" consisting of 4 dimple x 5 dimple sections of the drainage panel centered on the joint between the panels and spaced every 10

dimples along the length of the joint. Snap dimples of "lock strip" to dimples of each panel and reattach fabric over the panel joint.

c. Cut the core of the drainage panels around penetrations, and cut an "X" in the filter fabric and tape the fabric to the sides of the penetration.

d. Cover all terminal edges of the drainage composite with an integral fabric flap by tucking the fabric around the edge of the core and adhering the fabric to the bottom of the core.

3.4 INSTALLATION OF WATERPROOFING FOR BLINDSIDE WALLS AND BELOW GRADE UNDERSLAB WATERPROOFING

A. General: Install adhesive coated HDPE composite sheet according to waterproofing manufacturer's written instructions.

1. Install drainage layer directly over the membrane. Start at the low points on the wall and shingle all laps to the flow of water.

2. Splice drainage panels together by butting longitudinal edges of adjacent sheets and peeling back fabric to expose the cores of the panels. Install precut "lock strips" consisting of 4 dimple x 5 dimple sections of the drainage panel centered on the joint between the panels and spaced every 10 dimples along the length of the joint. Snap dimples of "lock strip" to dimples of each panel and reattach fabric over the panel joint.

3. Cut the core of the drainage panels around penetrations, and cut an "X" in the filter fabric and tape the fabric to the sides of the penetration.

4. Cover all terminal edges of the drainage composite with an integral fabric flap by tucking the fabric around the edge of the core and adhering the fabric to the bottom of the core.

B. Preparation

1. Surfaces to receive blind side membranes must be smooth and sound, with no gaps or voids in excess of 1/2 in. Earth and stone substrates must be compacted to produce an even, solid substrate. If required by membrane manufacturer, provide an additional layer of underlayment protection board over sharp or angular stone substrates. Surfaces to receive waterproofing shall be thoroughly dry and free of moisture.

2. General: Comply with manufacturer's instructions for preparing surface including joint or crack treatment.

3. Apply primer to substrate surfaces at rate recommended by manufacturer of primary waterproofing materials. Prime only area that will be covered by waterproofing membrane in same working day. Reprime areas not covered by waterproofing membrane within 24 hrs.

C. Wall Applications: Refer to manufacturer's literature for complete installation instructions but not limited to the following:

1. Apply drainage composite to a point 6" below grade line. Fasten drainage composite to the adjacent buildings foundation wall or soil retention system.

2. Peel back bottom flap of filter fabric and place core behind discharge pipe. Wrap loose filter fabric over and around discharge pipe. Tuck excess filter fabric behind pipe. Fold excess filter fabric at top termination down between drainage composite and membrane.

3. Apply membrane with the HDPE film facing the soil retention system or adjacent foundation. Remove the release liner and fasten membrane to Hydroduct drainage composite with large head nails or staples. All nail heads or staples must be covered with overlapping sheets of membrane.

4. Apply succeeding sheets by overlapping the previous sheet 3 inches along the uncoated edge of the membrane.

5. Overlap the ends of the membrane 3 inches. Apply Preprufe Tape centered over the end lap and roll firmly. Remove release liner.

6. Seal all transition, penetrations, tie down bracing and other conditions with initial membrane layer plus manufacturer's recommended accessory materials, prior to application of the full membrane.

7. Concrete must be poured within 30 days of membrane application. Protect membrane until concrete pour.

8. If membrane ties into a vertical membrane, leave an additional 12" flap of Preprufe membrane to tie into Bituthene membrane.

D. Underslab Applications

1. Apply specified drainage composite board as recommended by manufacturer over the compacted sub-grade.

2. Apply the membrane over the drainage composite board with the HDPE side facing the drainage composite board and the treated white coating surface facing the concrete to be poured. The membrane may be installed at any convenient length. Apply succeeding sheets by overlapping previous sheets 3" along the self-adhesive edge of the membrane. Remove the silicone coated release liner covering the membrane and roll the side lap to assure a tight seal.

3.5 SEAM REINFORCEMENT FOR HDPE COMPOSITE SHEETS ONLY

A. Provide a 6 in. strip of modified bituminous sheet membrane centered behind all laps.

B. At locations where a salvage edge is not present and at end laps, lap sheets 6 in., apply a 1/8 in. thick by 6 in. wide application of liquid membrane between sheets, to provide a 6 in. wide seal.

C. Integration of old onto new pre-applied sheet membrane.

1. Integration of Sheet Membrane onto Sheet Membrane that has been installed in excess of 30 days prior

    a. Lap sheets 12 in., apply a 1/8 in. thick by 12 in. wide application of fluid membrane between sheets, to provide a 12 in. wide seal at this location.
    b. Install Waterproofing Tape centered at edge of lap and roll firmly into place with an approved roller.
    c. Install additional Waterproofing Tape to cover white film that has been installed over 30 days prior.

2. Repair of pre-applied sheet membrane

    a. Scratch on white coating exposing underlying black surfing of Sheet Membrane: Install Waterproofing Tape at areas where the white coating of the membrane is damaged, including boot scuff marks and abrasions by rebar.
    b. Damage or Puncture of Sheet Membrane: Install Patch of short Membrane set in Liquid Membrane. Patch must extend 3 in. in every direction around extent of damaged area. Install Waterproofing Tape centered over the edge of the patch. If the damaged area does not have 5 in. of sound material around it, inject Liquid Membrane into puncture until Liquid Membrane backs out, and proceed with patch as space allows.

3.6 INSTALLATION OF PLAZA AND/OR TERRACE WATERPROOFING

A. Apply membrane from the low point to the high point so that laps shed water. Overlap all seams at least 2". Stagger all end laps. Roll the entire membrane firmly and completely as soon as possible. Use a linoleum roller or standard water-filled garden roller less than 30" wide, weighing a minimum of 75 lbs. when filled. Cover the face of the roller with a resilient material such as a plastic foam or two wraps of indoor-outdoor carpet to allow the membrane to fully contact the primed substrate. Seal all T-joints and membrane terminations with Bituthene Mastic or Bituthene Liquid Membrane at the end of the day.

B. Patch tears and inadequately lapped seams with membrane. Slit fishmouths, repair with a patch extending 6" in all directions from the slit and seal edges of the patch with Bituthene Mastic. Do not apply Bituthene Mastic where it will be covered with membrane, except when used as a temporary cut-off.

C. Flood test application of waterproofing in accordance with Article 3.7 herein.

D. After flood testing and repairs is complete, cover membrane with drainage composite board using tape and/or adhesive per manufacturer's recommendations.

3.7 WATER TEST

A. Water tests shall be conducted for horizontal applications at Plazas and Terraces and must be judged to be successful by the City of New York, before the installation of any subsequent components of the waterproofing system. Do not conduct water test during rain, other inclement weather, or if sections of exposed structural deck adjacent to the test area contain standing water or are wet.

B. Water test areas of membrane that are penetrated by dowels, electrical conduit, etc. after the penetrations are installed through the membrane and flashed. Testing the penetrations may be done as part of a test of a larger area or as separate test of individual or grouped penetrations after the membrane has been successfully tested.

C. Before beginning test, check area below membrane, and note any existing active leaking from other sources.

D. Test for leaks by plugging drains, damming the area and filling area with min, 2 in. of water, and let stand for 24 hours.

E. Check area below membrane for active leakage before releasing water.

F. Drain water and mark all area where water stands (flat areas).

G. Examine spaces below deck for signs of leakage, and walk all membrane seams watching for signs of "bubbling" or expulsion of water. Critically examine all seams in flat areas of standing water.

H. If leakage occurs, inspect the membrane and repair or replace defective areas.

I. Continue to water test until area being tested passes test.

3.8 CLEAN-UP

A. Upon completion of the waterproofing system, the General Contractor shall remove all equipment, material and debris from the work and storage area, and leave those areas in an undamaged and acceptable condition.

END OF SECTION

SECTION 071413

FLUID MEMBRANE WATERPROOFING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the waterproofing as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Preparation of surfaces to receive fluid applied waterproofing.
2. Fluid applied waterproofing system on structural concrete deck below Plaza.
3. Installation of rigid insulation at Plaza.
4. Fluid applied waterproofing system on foundation walls and below-grade vaults.
5. Sealant work in conjunction with fluid applied waterproofing.
6. Water testing of fluid applied waterproofing.
7. Temporary protection of fluid applied waterproofing systems until covered by work of this Section.
8. Supervision of installation of fluid applied waterproofing system by manufacturer's representative of fluid applied waterproofing material.
9. Warranty of fluid applied waterproofing system.

1.3 RELATED SECTIONS

A. Concrete deck - Section 033000.

B. Drains - Division 22.

C. Excavation - Section 312000.

1.4 SUBMITTALS

A. Shop Drawings - submit for: Typical installation details, showing details at drains, at reinforcing flashings, at terminations, at joints in structure below, at intersection of horizontal and vertical surfaces, at penetrations in membrane systems.

B. Samples - Submit:

1. Fluid applied membrane, cured sample.
2. Insulation material, 12" x 12".
3. Flashing material, 12" x 12".
4. Drainage layer, 12" x 12".
5. Protection sheet, 12" x 12".
6. Reinforcing sheet, 12" x 12".

C. Manufacturer's Literature: Submit manufacturer's technical and installation literature for all materials of this Section.

D. Submit certification from an independent testing laboratory that the rubberized asphalt waterproofing material conforms to the CGSB 37-GP-50 Standard.

E. Submit certification from the manufacturer showing full time quality control of rubberized asphalt production facilities and that each batch is tested to ensure conformance with published physical properties.

F. Submit certification from membrane manufacturer that all components of assembly are compatible and shall be covered by a single source warranty.

G. Contractor's Certification: Submit per Article 1.8.

H. Subcontractor's Qualifications: Submit per Article 1.9.

I. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product

listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 PRODUCT HANDLING

A. Deliver materials in original unopened containers or packaging clearly labeled with manufacturer's name, brand name, instruction for use, all identifying numbers, and UL labels.

B. Materials shall be stored in a neat, safe manner, not to exceed the allowable structural capacity of the storage area.

C. Store materials in a clean, dry area protected from water and direct sunlight.

D. Store all adhesives at temperatures between 60 degrees F. and 80 degrees F. If exposed to lower temperatures, restore materials to 60 degrees F. minimum temperature before using.

E. Do not use materials damaged in handling or storage.

1.6 JOB CONDITIONS

A. Application of the membrane shall not commence nor proceed during inclement weather. All surfaces to receive the membrane shall be free of water, dew, frost, snow and ice.

B. Application of membrane shall not commence nor proceed when the ambient temperature is below 0 degrees F.

C. Preparation and application of membrane must be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180 degrees F. (i.e. hot pipes and vents or direct steam venting, etc.)

E. Adhesives contain petroleum distillates and are extremely flammable. Do not breathe vapors or use near an open fire. Do not use in confined areas without adequate ventilation. Consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information (available from Hydrotech).

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the PRM (Protected Roof Membrane). Any exposure to foreign materials or chemical discharges must be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.

1.7 PROTECTION

A. Against Loads: Protect work of this Section against concentrated loads and any other loads or equipment that would damage the materials or work. Use boards or other approved means to safely distribute the loads.

B. Against Traffic: Do not permit traffic on work of this Section except for workmen doing the work, during the installation and after the installation, until covered with protective boards or with the specified protection of finish materials. Take necessary preventive measures to protect work of this Section from damage during and after application, until traffic is permitted.

C. Rejection of Damaged Work

1. Damaged materials or work will be rejected.

2. Rejected materials or work must be immediately removed and replaced with new materials, at the Contractor's expense.

1.8 MANUFACTURER'S REPRESENTATIVE

A. Contractor shall require representative of the manufacturer of the fluid applied waterproofing material to provide field instructions and supervision for the installation of the complete fluid applied waterproofing system at the start of the work of this Section.

B. Contractor shall require the manufacturer's representative to make sure that the Subcontractor's workmen are fully instructed and trained in the handling and application of all the materials, and shall see that the materials are correctly installed.

C. Upon completion of the installation, the Contractor shall submit to the Commissioner written certification that the representative of the manufacturer of the fluid applied waterproofing material has supervised the work of this Section and that all materials were correctly installed.

1.9 QUALIFICATIONS OF SUBCONTRACTORS

A. Subcontractors: All work of this Section shall be performed by an Installer who is properly trained by the manufacturer of the fluid applied waterproofing materials.

B. Qualifications of Installers: Installers shall submit evidence of being bona fide waterproofing subcontractors and that they are properly trained by the manufacturer of the fluid applied waterproofing material for the installation of their material and in accordance with the requirements of this Section. Installer shall submit letter from manufacturer of fluid applied waterproofing material stating that subcontractor is

properly trained by the manufacturer for the application of the fluid applied waterproofing system specified for the Project. Letter shall certify that the Installer has satisfactorily applied the fluid applied waterproofing system specified herein under the manufacturer's supervision. Letter shall be on manufacturer's letterhead and shall be signed by an officer of the company.

1.10 WARRANTY

A. Waterproofing Contractor: 2 years.

B. Waterproofing System Manufacturer: 10 year Material Warranty.

C. Waterproofing System Manufacturer: 10 Year Single Source Watertight Warranty on waterproofing areas including removal and replacement of separation sheet, drainage material, insulation and flashing. Warranty shall state:

1. The membrane and flashing will remain watertight for ten years.

2. Both material and workmanship problems are covered.

3. The insulation will retain at least 80% of its thermal value.

4. In the event that the waterproofing fails to perform, manufacturer/supplier shall make repairs to the waterproofing to enable it to perform as warranted.

5. Removal and replacement of overburden is covered under this warranty.

1.11 LEED PERFORMANCE REQUIREMENTS

A. Fluid applied waterproofing shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Fluid applied waterproofing materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Membrane: Membrane shall be a hot, fluid applied, fabric reinforced rubberized asphalt membrane equal to American Hydrotech Liquid Membrane 6125 FR, or approved equal made by Carlisle or Tremco, meeting the following physical properties:

Properties	Test Method	Requirements
Flash point	ASTM-D-92, CGSB 37-GP-50M	500 degrees F (260 degrees C)*
Low temperature crack bridging capability	CGSB 37-GP-50M	No cracking, adhesion loss, or splitting
Water vapor permeability	ASTM-E-96, PROCEDURE E, CGSB 37-GP-50M	1.7 ng/Pa(s)m^2 max (0.027 perm)
Water resistance (5 days/50 degrees C)	CGSB 37-GP-50M	No delamination, blistering, emulsification, or deterioration.
Water absorption	CGSB 37-GP-50M	Gain in weight 0.35 g max loss in weight 0.18 g max
Elasticity/Ratio of Toughness to Peak Load	CGSB 37-GP-50M	Min. toughness of 5.5 joules (48.67 in pound)/.04
Viscosity	CGSB 37-GP-50M	2 - 15 seconds
Heat Stability	CGSB 37-GP-50M	No change in viscosity, penetration, flow or low temperature flexibility
Low temperature flexibility (-25 deg.C)	CGSB 37-GP-50M	No delamination, adhesion loss, or cracking
Penetration	ASTM-D-1191, CGSB-37-GP-50M	77 degrees F (25 degrees C) max 110, 122 degrees F (50 degrees C) max 200
Flow	ASTM-D-1191 CGSB 37-GP-50M	140 degrees F (60 degrees C) 3.0 mm-max
Softening point	ASTM-D-36	180 degrees F (82 degrees C)
Elongation	ASTM D-1191	1000% min.
Resiliency	ASTM-D-3407	40% min.
Bond to Concrete (0 degrees F, -18 degrees C)	ASTM-D-3408	Pass
Acid Resistance	ASTM-D-896-84, Procedure 7.1, Note 8	Pass-Nitric Acid Sulfuric Acid
Solids Content		100% - no solvents
Shelf Life		6 years (sealed containers)
Specific gravity		1.25

* or alternatively not less than 77 degrees F (25 degrees C) above the manufacturer's maximum recommended application temperature.

B. Flashing/Reinforcing

1. 60 mil thick, red lead catalyst, uncured neoprene flashing/reinforcing sheet.

2. Spunbonded polyester fabric reinforcing sheet.

C. Surface Conditioner: An asphalt based primer for concrete surfaces meeting ASTM D 41-85 and/or CGSB 5M.

D. Adhesives

1. Contact adhesive used to bond flashing to an approved substrate shall be roofing manufacturer's surface conditioner.

2. Contact adhesive used to bond flashing together shall be roofing manufacturer's splicing cement.

E. Sealant

1. Sealant used to seal laps of neoprene flashing shall be roofing manufacturer's lap sealant.

2. Sealant used to adhere membrane flashing shall be as follows, or approved equal by other manufacturers listed above:

a. Membrane flashing to Substrate: Bonding adhesive
b. Membrane to membrane: Heat weld or bonding adhesive
c. Visible Seams and Joints: Standard white lap sealant

F. Protection Sheet: A heavy duty fiberglass reinforced, rubberized asphalt sheet minimum 85 milthick with sand broadcast on horizontals and verticals.

G. Fabricated Drainage Layer (where noted): A high density polyethylene drainage core bonded to a calendered non-woven geotextile with a minimum compressive strength of 30,000 psf.

H. Insulation: As furnished by Section 072100.

PART 3 EXECUTION

3.1 INSPECTION - WATERPROOFING CONTRACTOR

A. Examine all surfaces to receive the waterproofing materials to ensure a proper installation. Verify the following:

1. Type, strength, density, and cure time of concrete.

2. Wood float finish, free from defects.

3. Structural limitations of deck.

4. Proper drains and other flashing details.

5. Proper slab slope.

B. Do not proceed with waterproofing application until all defects are repaired.

3.2 PREPARATION

A. All surfaces must be dry, smooth, rigid, clean, frost free and free of voids, sharp protrusions or other defects or contaminants, including unapproved curing compounds and form release agents.

1. Poured in Place concrete decks shall be smooth, monolithic, and free of voids, spalled areas, honeycombs, loose aggregate and sharp protrusions. Normal Weight concrete (minimum 2500 psi compressive strength and 135 pcf density) shall be cured a minimum of 14 days.

3.3 INSTALLATION: GENERAL REQUIREMENTS

A. Final Substrate Cleaning

1. Thoroughly sweep the substrate which is to receive membrane.

2. The substrate must also be blown clean using an air compressor to remove any remaining loose debris.

B. Surface Conditioner Application (Concrete Surfaces)

1. Apply the surface conditioner to the substrate using a hand held sprayer, or a short nap roller, evenly at a rate of 300 to 600 square feet per gallon (depending on surface texture). Surface conditioner shall "tan" the concrete surface, not blacken it.

2. Allow sufficient time for the surface conditioner to thoroughly dry prior to the membrane application. Membrane will not bond to surface conditioner which has not dried.

3. Do not spray surface conditioner onto previously installed membrane.

C. Membrane Preparation

1. The membrane shall be heated in a double jacketed, oil bath melter with mechanical agitation, specifically designed for the preparation of hot-applied, asphalt materials.

2. Heat membrane until the material can be drawn-free flowing at a temperature range between 350 degrees and 425 degrees F.

3.4 REINFORCING FLASHING

A. General: See Article 3.3 for application of surface conditioner for hot applied waterproofing membrane material prior to application of reinforcing flashing.

Reinforcing flashing (rubber flashing sheet) shall be installed in long lengths with min. number of splices. Splices in reinforcing flashing shall be made by lapping reinforcing flashing 4" min. and sealing lap with adhesive specified herein. Make splices prior to installing reinforcing flashing. Reinforcing flashing shall be embedded in waterproofing membrane coating while still warm and tacky, and then covered with waterproofing membrane on the same day as the embedment of the reinforcing flashing.

B. Cracks and Non-working Joints: To cracks, concrete construction joints, concrete pour joints, and other non-working joints up to and not exceeding 1/8" in width, apply a 6" wide strip of spunbonded polyester fabric reinforcement. Center the strip over the crack or joint. Roll strip into a 1/8" coating of waterproofing membrane, and apply a second coat of waterproofing membrane over the strip extending a min. of 6" beyond strip edges.

C. Control Joints and Expansion Joints Up To 1/2" Wide: Joints 1/2" and smaller shall first be sealed by backing joint with oakum (place oakum in a joint to a depth of 1/2"), then fill joint with fluid applied membrane. Embed a 24" wide strip of 60 mil uncured neoprene centered over the joint 1/8" coating of waterproofing membrane. Apply a second coat of membrane over strip extending a minimum of 12" beyond strip edges. For expansion joints from 1/2" to 1" in width, the 60 mil uncured neoprene sheet shall be looped down into the joint between 1-1/2" and 1-3/4" from the horizontal concrete surface and otherwise embedded and coated in the same manner as for cracks and non-working joints, except that the sheet shall be supplied wide enough to extend at least 6" on either side of the expansion joint.

D. Corners, Joints Between Horizontal and Vertical Surfaces, Non-monolithic Changes in Place, and Membrane Penetrations:

1. For external and internal corners, construction joints and expansion joints between horizontal and vertical surfaces, non-monolithic changes in place, and penetrations in membrane surface, the same procedures as specified above under paragraphs A, B, and C of this Article shall apply. Carry rubber flashing sheet min. of 3" up the vertical surface and 3" out onto the horizontal surface, unless otherwise indicated.

E. Drains: At drains, use 60 mil uncured neoprene flashing sheet, carefully cut to suit openings of drain and to extend onto entire surface of drain flange and at least 6" beyond edge of drain flange. Embed rubber flashing sheet into 1/8" coating of waterproofing membrane, and apply a second coat of waterproofing membrane onto the rubber flashing sheet and extending a min. of 6" beyond outer edge of flashing sheet. Drains shall be as recommended by membrane material manufacturer. The drain flange shall be slightly below the membrane level. The waterproofed surface must be allowed to drain at the membrane surface level. Drain collar shall have a sufficient number of weep holes to provide adequate drainage. Contractor shall coordinate drain requirements with his roofing subcontractor and with the plumbing contractor.

F. Flashing: At parapets, curbs, wall junctures or other conditions where flashing is to be exposed, use 60 mil uncured neoprene. The uncured neoprene flashing should extend a minimum of 3" out onto the deck and up the vertical surface to its termination point. No exposed flashing, membrane shall terminate in reglet below finished grade or

sidewalk as detailed on drawings. The uncured neoprene sheet should be secured to the vertical surface (except the bottom 3") with bonding adhesive. The fluid applied membrane should then be applied into the juncture underneath and behind the uncured neoprene sheet (1/8" min. thickness) 3" up the vertical and 6" out onto the deck. The uncured neoprene should then be embedded into the warm fluid applied membrane should then be applied (1/8" min.) to the top of the uncured neoprene that rests on the deck totally encapsulating the uncured neoprene sheets edge.

1. The uncured neoprene flashing shall be used in lengths as long as possible. When a lap or seam between one sheet and another must be made, use splicing cement to joint them (min. lap width, 4") and lap sealant to seal the sheet lap edge.

3.5 APPLICATION OF MEMBRANE

A. Surface Conditioner: After preparation of surfaces as specified above, but prior to installation of reinforcing flashing and membrane, apply specified surface conditioner to the substrate surfaces at rate of 300 to 600 sq. ft. per gal. depending on the concrete surface and as recommended by the waterproofing manufacturer. Protect surface conditioner from rain until dry.

B. Membrane Application: Apply the rubberized asphalt membrane at a rate to provide a continuous, monolithic coating of 90 mils, into which is fully embedded a layer of Flex Flash F, followed by another continuous monolithic coat of membrane at a minimum thickness of 125 mils. Monitor thickness by laying out formula of gallons/sq. ft. as recommended by the manufacturer.

3.6 PROTECTION SHEET INSTALLATION

A. Embed the protection sheet into the membrane while it is still hot to ensure that a good bond between them is achieved.

B. On horizontals, overlap adjoining sheet edges (dry) a minimum of 2-3 inches to ensure complete coverage. The adhere laps using hot rubberized asphalt. On verticals, protection or insulation boards should be butted tightly.

C. The Protection Sheet must be covered by the topping materials as soon as possible, within 30 days of membrane installation. In the event that topping materials are not installed immediately, provide interim protection for liquid membrane waterproofing system until permanent protection slabs or other toppings are installed.

3.7 WATER TEST

A. All areas should be water tested by ponding water a minimum depth of 2" for a period of 48 hours to check the integrity of the installation. Before testing, it should be verified that the structure can support the dead load of the water. If leaks occur the water must be drained completely, and the membrane installation repaired, and the test run again.

3.8 INSULATION PLACEMENT ABOVE THE MEMBRANE

A. Prefabricated Drainage Layer: Install under insulation set dry following manufacturer's instructions.

B. Insulation Placement

1. Insulation shall be placed on the drainage layer as each section of the membrane installation is completed.

2. Loose lay insulation in a staggered manner and tightly butt together all insulation boards. The maximum acceptable opening between insulation boards is 3/8". Insulation must be installed within 3/4" of all projections, penetrations, cant strips, etc.

3.9 JOB COMPLETION

A. Contractor shall inspect the completed system and correct all defects.

B. Clean up all debris and equipment.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 072100

THERMAL INSULATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the thermal insulation as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Insulation under slabs-on-grade.
2. Foundation wall insulation.
3. Cavity wall insulation within masonry cavity.
4. Concealed semi-rigid building insulation behind drywall.
5. Roofing insulation.
6. Attachment devices.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Firestops and smokeseals - Section 078413.

C. Acoustical insulation - Section 092900.

D. Earthwork - Section 312000.

1.4 SUBMITTALS

A. Submit product data for each type of product indicated, including recycled content.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01

LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Insulation materials shall contain recycled content as follows:

1. Fiberglass insulation shall contain a minimum of 20% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).

2. Mineral wool insulation shall contain a minimum of 75% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).

3. Extruded polystyrene insulation shall contain a minimum of 20% (by weight) recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage.

4. Other types of insulation shall contain recycled content as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content values shall be in accordance with Division 01 LEED Requirements Section.

B. Building insulation materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site ready for use in the manufacturer's original and unopened containers and packaging, bearing labels as to type and brand. Delivered materials shall be identical to approved samples..

B. Store materials under cover in a dry and clean location, off the ground. Remove materials which are damaged or otherwise not suitable for installation and replace with acceptable materials.

C. Take every precaution to prevent the insulation from becoming wet, cover with tarps or other weather/watertight sheet goods.

PART 2 PRODUCTS

2.1 FOUNDATION WALL AND UNDERSLAB INSULATION

A. Provide extruded polystyrene board insulation equal to "Styrofoam" manufactured by Dow Chemical Co., or approved equal made by Owens Corning or PACTIV Building Products, conforming to ASTM C 578, Type IV, with a maximum flame spread and smoke developed indices of 75 and 450 respectively.

B. Insulation shall have an aged R value of not less than 5/inch; shall be 2" thick unless otherwise noted on the drawings.

2.2 CAVITY WALL INSULATION WITHIN MASONRY CAVITY

A. For projects located in New York City, insulation within masonry cavity shall be a mineral wool fibre board insulation equal to "Cavity Rock" made by Roxul Inc. or approved equal conforming to the following:

1.	ASTM C 612	Mineral Fiber Block and Board Thermal Insulation	Type 4B, Complies
2.	MEA Approval	New York City Approval	236-05-M
3.	ASTM E 136	Behavior of Materials at	Non-Combustible

750 Deg. C (1382 deg. F.)

4.	ASTM E 84 (UL 723)	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0
5.	ASTM C 356	Linear Shrinkage	<2% @ 1200 deg. F.
6.	ASTM #96	Water Vapor Transmission, Desiccant Method	1895 ng Pa. s. m^2
7.	ASTM C 1104	Moisture Sorption	0.03%
8.	ASTM C 518 (C 177)	R-value/inch @ 75 deg. F.	4.2 hr.ft.2F/Btu
9.	Density	ASTM C 303	4.5 lbs./cu. ft.

2.3 CONCEALED SEMI-RIGID BUILDING INSULATION BEHIND DRYWALL

A. Provide semi-rigid mineral wool insulation equal to "Thermafiber FS-25" made by the Thermafiber Co. or equal made by Fibrex or Roxul conforming to ASTM C 612, Type 1A and 1B faced on one side with foil scrim Kraft vapor retarder, maximum flame spread and smoke developed indices of 25 and 5 respectively.

B. Insulation shall have an R value of not less than 4/inch with a nominal density of 4 lbs./cu. ft.

C. Insulation shall be 4" thick unless otherwise noted on the drawings.

2.4 ROOFING INSULATION

A. Location: Under precast slab over basement and in eave cavity – 4 inches thick rigid board.

1. Insulfoam

2. Tech4

3. Or equivalent

B. Refer to Section 073360 for roofing insulation beneath vegetated roof.

2.5 ACCESSORIES

A. Clips for Securing Insulation to Encountered Surfaces: Spindle anchor and washer type consisting of perforated metal plates with spindle welded to center and snap on washers. Spindle and washers shall receive a corrosion-resistant electro-zinc plating. Adhesives for securing clips in place shall be recommended by the approved clip manufacturer.

1. Acceptable Manufacturers

a. Miracle Adhesives Corp.

b. Stic-Klip Mfg. Co., Inc.
c. Midwest Fasteners

B. Adhesive for Bonding Insulation: The type recommended by the insulation manufacturer, and complying with fire-resistance requirements.

1. For bonding rigid polystyrene insulation to masonry or concrete, provide adhesive equal to "Foamgrab PS" made by Dacor Products Co. or equal made by ChemRex Inc. or Miracle Adhesives.

C. Protection Board: Premolded, semi-rigid asphalt/fiber composition board, 1/4" thick, formed under heat and pressure, standard sizes.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where thermal insulation is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. General

1. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

2. Install insulation in as large components as practical and to cover entire areas indicated on the drawings, closely butted together at sides and ends, and against walls, beams, etc. Neatly fit and cut insulation around all projections such as pipes, conduits, hangers and all other elements encountered in the field, which will result in complete coverage of the scheduled areas.

3. Discard, off the site, insulation which becomes damaged during the course of installation, or is no longer in a physical condition to function for use intended, and replace with new material.

4. Clean surfaces on which adhesives are used to secure the insulation in place of dirt, grime, grease, oil and other foreign materials, to assure that the surfaces are properly prepared to accept the bond of the approved adhesives.

5. Exercise extreme care to avoid damage and soiling of faces on insulation units which will be exposed to view. Align joints accurately, with adjoining surfaces set flush.

6. Set vapor barrier faced units with vapor barrier to inside of construction, except as otherwise shown. Do not obstruct ventilation spaces. All joints in vapor barriers

shall be sealed with 4" wide, foil faced duct tape to prevent vapor and air migration.

7. Tape joints and ruptures in vapor barriers, using tape specified above, and seal each continuous area of insulation to surrounding construction so as to ensure vapor tight installation of the units.

8. Where insulation is impaled on stick clips, provide clips not less than 3" from corners or edges and not more than 12" o.c.

9. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

10. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

11. Apply a single layer of insulation to the required thickness, unless a double layer is required, to make up the total thickness shown.

12. Furnish mason trades rigid insulation to be installed within masonry cavity.

3.3 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type of adhesive as specified herein.

1. Extend insulation 24" below grade unless otherwise noted on the drawings.

B. Protect below-grade insulation on vertical surfaces (from damage during back-filling) by application of protection board. Set in adhesive in accordance with recommendations of manufacturer of insulation.

C. Protect top surface of horizontal insulation (from damage during concrete work) by application of protection board.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Install small pads of adhesive spaced approximately 1'-0" o.c. both ways on inside face, as recommended by manufacturer. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction.

3.5 INSTALLATION OF SEMI-RIGID MINERAL WOOL INSULATION

A. Install wall insulation with edges closely butted, with joints square, straight and in alignment (no staggered), and with vapor barrier facing on warm side of building, and with exposed faces flush and in the same plane without warp or twist. Cut and fit insulation to closely fit intersecting or penetrating surfaces. Seal joints between insulation, between insulation and intersecting or penetrating surfaces and between

insulation and perimeter surfaces with 4" wide vaporproof aluminum tape applied on the vapor barrier side. Insulation shall be friction fit between furring channels or studs.

B. Where insulation is installed directly below structural deck, fasten to deck using stick clips as specified herein. Space clips 12" o.c. both direction and impale insulation on clips. Insulation shall be installed with vapor barrier facing down. Butt ends and edges of insulation together and tape joints using 4" wide vaporproof aluminum tape over vapor barrier.

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.7 INSULATION SCHEDULE

A. BI-01 Rigid Board Insulation. Location: below grade concrete walls, footings. 2 inches thick, R5/inch, XPS type, vertical drainage channels on one face, 30 psi min.

1. Owens Corning
2. Dow
3. PACTIV Building Products
4. Or approved equal

B. BI-02 Semi-Rigid Cavity Insulation. Location: exterior soffit, masonry cavity. 3 1/2" thick, R4.2/inch.

1. Roxul
2. Thermafiber
3. Fibrex
4. Or approved equal

C. BI-03 Unfaced Thermal Batt Insulation. Location: interior wall cavity. 3 1/2" thick, R=13.

1. Owens Corning
2. Dow
3. PACTIV Building Products
4. Or approved equal

D. BI-04 Roof Insulation. Location: entirely above roof deck. 6 inches thick, R5/inch, XPS type, two-way drainage channels on one face, 60 psi min.

1. Owens Corning
2. Dow
3. PACTIV Building Products
4. Or approved equal

E. BI-05 Spray Foam. Location: building envelope and curtain wall metal closures, clerestory structural and non-structural posts. Thickness varies.

1. Owens Corning
2. Dow
3. BASF
4. Or approved equal

F. BI-06 Rigid Board Insulation. Location: under slab on grade. 2 inches thick, R5/inch, XPS type, 60 psi min.

1. Owens Corning
2. Dow
3. PACTIV Building Products
4. Or approved equal

G. BI-07 Semi Rigid Under-deck Insulation. Location: beneath slab above in mechanical and unconditioned/partially conditioned spaces. 4 inches thick, R4.1/inch, mineral wool fiber composition, non-combustible, moisture repellent, white reflective facing.

1. Roxul.
2. Thermafiber
3. Fibrex.
4. Or approved equal.

END OF SECTION

SECTION 072423

DIRECT-APPLIED SOFFIT FINISH SYSTEM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor materials, equipment, and services necessary to complete the direct-applied soffit finish system as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Suspended self-furring metal lath and suspension system.
2. Glass mat faced gypsum backer board.
3. Finish system.
4. Plastic accessories (casing beads, expansion joints, etc.).
5. Sealing at lighting fixtures and other penetrations through the ceiling system.

1.3 RELATED SECTIONS

A. Steel Deck - Section 053100.

1.4 REFERENCE DOCUMENTS

A. American Standards for Testing and Materials (ASTM):

1. ASTM C 150 Specification for Portland Cement.
2. ASTM C 297 Test Method for Tensile Strength of Flat Sandwich Constructions in Flatwise Plane.
3. ASTM C 1178 Specification for Glass Mat Water-Resistant Gypsum Backing Board.
4. ASTM D 968 Test Method for Abrasion Resistance of Organic Coatings by Falling Abrasive.
5. ASTM D 1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

6. ASTM D 2247 Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

7. ASTM D 3273 Test for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

8. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.

9. ASTM E 96 Test Methods for Water Vapor Transmission of Materials.

10. ASTM E 119 Method for Fire Tests of Building Construction and Materials.

B. EIMA (EIFS Industry Members Association) Standards and Publications:

1. 105.01 Standard Test Method for Alkali Resistance of Glass Fiber Reinforcing Mesh for use in Exterior Insulation and Finishing Systems (EIFS), Class PB.

1.5 PERFORMANCE REQUIREMENTS

A. System Performance:

TEST	METHOD	CRITERIA
Impact Resistance	EIMA 101.86	High: 90 to 150 in-lbs (10.2 to 17.0J)
Adhesion	ASTM C 297	Minimum 10 psi
Adhesion after 10 Freeze/Thaw Cycles	ASTM C 297	Minimum 10 psi

1. Mildew Resistance (ASTM D 3273): No growth supported during 28 day exposure period; no growth at 42 days.

2. Alkali Resistance of Reinforcing Mesh (EIMA 105.01): Greater than 120 retained tensile strength.

3. Surface Burning (ASTM E 84): Base coat and finish coat each have a flame spread of 25 or less and smoke developed of 450 or less; all components passed.

1.6 SUBMITTALS

A. Submit the following:

1. Manufacturer's specifications, details, installation instructions and product data.

2. Shop drawings of furring and lathing, framing and control joints

3. Applicator's certificate of instruction.

4. Samples for approval as directed by Commissioner or City of New York.

5. Manufacturer's 2-year labor and materials warranty.

6. A list of job references.

7. Sealant Manufacturer's test data.

8. Prepare and submit project-specific details (when required by contract documents).

B. Mock-Up: Construct 4' x 4' mock-up of finish on sheathing back-up at the job site. Adjust mock-up until it meets with Commissioner's approval. Approved mock-up shall become the standard to which all work must conform.

1.7 QUALITY ASSURANCE

A. Manufacturer requirements: System manufacturer for a minimum of 3 years.

B. Contractor Requirements:

1. Knowledgeable in the proper use and handling of specified materials.

2. Employ skilled mechanics who are experienced and knowledgeable in specified product application, and familiar with the requirements of the specified work.

3. Successful completion of projects of similar size and complexity to the specified project.

4. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with manufacturer's published specifications and details and the project plans and specifications.

1.8 PRODUCT HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.

B. Protect coatings (pail products) from freezing and temperatures in excess of 90° F. Store away from direct sunlight.

C. Protect Portland cement based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

1.9 JOB CONDITIONS

A. Maintain ambient and surface temperatures above 40° F during application and drying period, minimum 24 hours after application of the system.

B. Provide supplementary heat for installation and drying times in temperatures less than 40° F.

C. Provide protection of surrounding areas and adjacent surfaces from application of materials.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide "Sto Quik Gold Finish System for Soffits" by Sto Corp., or equivalent product of Senergy, Dryvit, or approved equal.

2.2 ACCESSORIES

A. Corner bead, casing bead, starter track, expansion and control joint accessories. All accessories shall meet the requirements of ASTM C 1063 and its referenced documents. Accessories shall be vinyl (ASTM D 1784) as selected by the Commissioner.

2.3 SHEATHING

A. "Dens Glass Gold" sheathing as manufactured by Georgia-Pacific Corp. or equal by USG, Natiional Gypsum or approved equal. Sheathing shall be approved by finish system manufacturer.

2.4 BASE COAT

A. One-component polymer modified cementitious high build base coat with less than 33 percent Portland cement content by weight.

2.5 REINFORCING MESH

A. Standard Mesh: Mesh; nominal 4.5 oz./yd.^{2} (153 g/m^2), symmetrical, interlaced open-weave glass fiber fabric made with minimum 20 percent by weight alkaline resistant coating for compatibility with Sto materials.

B. Specialty Mesh

1. Corner Mat: Nominal 6.25 oz./yd.^{2} (212 g/m^2), pre-creased, heavy-duty, open-weave woven glass fiber fabric with alkaline resistant coating for compatibility with Sto materials (used for maximum impact protection at inside and outside corners).

2. Detail Mesh: Nominal 4.5 oz/sq yd (153 g/m^2), flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating for compatibility with materials (used for standard EIFS backwrapping and aesthetic detailing).

2.6 PRIMER

A. Primer: Acrylic based primer.

2.7 FINISH COAT

A. Acrylic based or silicone enhanced textured wall coating.

2.8 MIXING

A. Mix ratio with water: 7 to 9 quarts (6.6 to 8.5 L) of water per 60 pound (27.3 kg) bag of base coat. Pour water into a clean mixing pail. Add Sto BTS-PLUS (or equal), mix to a uniform consistency with clean, rust-free electric drill and paddle. Allow to set for approximately 5 minutes, then remix. Adjust mix if necessary with additional base coat or water and remix to a uniform trowel consistency. Avoid retempering. Keep mix ratio consistent.

B. Primers: Mix to a uniform consistency using a clean, rust-free, high-speed electric drill mixer.

C. Finishes: Mix to a uniform consistency using a clean, rust-free high speed electric drill mixer. A small amount of water may be added to adjust workability. Limit addition of water to amount needed to achieve the finish texture.

D. Mix only as much material as can readily be used.

E. Do not use anti-freeze compounds or other additives.

2.9 SUSPENSION SYSTEM PRODUCTS

A. Main Carrying Channels: Provide 1-1/2" cold rolled galvanized steel carrying channels weighing 475 lbs. per 1000 lin. ft. Space channels 3'-0" o.c.

B. Furring Channels: Provide 3/4" cold rolled galvanized steel furring channels weighing 300 lbs. per 1000 lin. ft. Space furring channels 16" o.c.

C. Hangers and Supports

1. Hangers shall be 1" x 3/16" galvanized steel flats or ¼" galvanized rods spaced 4'-0" o.c.

2. Provide ceiling inserts to receive hangers, type and size of insert to support not less than 5 x calculated hanger loading.

3. Provide 18 gauge galvanized wire ties for lathing and accessories.

D. Galvanizing shall be hot-dip galvanizing conforming to ASTM A 653, G60 coating.

2.10 JOINT SEALANT

A. Sealant shall be single component neutral cure silicones, single component moisture cure polyurethanes, or evaporative cure acrylic latex.

B. Provide backer rod and accessories to comply with requirements specified in Section 079200.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where direct-applied finish system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION OF METAL SUSPENSION SYSTEM

A. Where lathing and metal support system abuts building structure horizontally, and where partition/wall abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading into the work from the building structure. Install slip or cushion type joints to absorb deflections and maintain lateral support.

1. Frame both sides of control and expansion joints independently and do not bridge joints with furring and lathing or accessories.

B. Install supplementary framing, blocking and bracing where required to support fixtures, grilles, etc., within ceiling construction.

C. Splicing Members: Lap furring members 8" and runner channels 12", and wire-tie near each end of lap. Splice accessories by use of concealed splines, anchored to prevent offsets.

D. Space main carrying channels 3'-0" o.c.; level channels to a tolerance of 1/8" in 12'-0" and space hangers along channels 3'-0" o.c.

E. Secure hangers to channels and to overhead supports to comply with referenced standards.

F. Wire tie furring channels to main carrying channels 16" o.c. Install metal lath to furring channels by wire-tying or clipping to furring channels in accordance with industry standards.

G. Install furring and lathing plumb, level and true to line with a tolerance of 1/8" in 10'-0" and in accordance with industry standards. Space expansion joints as indicated on drawings.

H. Fasten sheathing to ceiling framing with 1" stainless steel screws spaced 3/8" from ends and edges and approx. 8" o.c. Apply sealant between joints and trowel flush; and apply sealant around sheathing perimeter and at interface with other materials. Cover fastener heads with sealant and trowel flush.

3.3 EXAMINATION

A. Inspect structural framing for:

1. Stud Size/ Spacing/ Depth: Minimum 18 gauge, 3- 5/8 inch (91 mm) metal studs spaced a maximum of 16 inches (400 mm) on center.

2. Straightness, trueness and uniformity of dimension.

3. Compliance With Tolerances: Horizontal alignment within 1/8 inch in 10 feet (3 mm in 3 m) of the soffit length.

4. Framing Construction: Framing members provided wherever joints in sheathing occur and constructed in accordance with applicable building code requirements.

B. Inspect sheathing surfaces for:

1. Contamination: Algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances.

2. Cracks: Measure crack width and record location of cracks.

3. Damage and deterioration.

4. Moisture Content and Moisture Damage: Use a moisture meter to determine if the surface is dry enough to receive the coatings and record any areas of moisture damage.

5. Compliance With Specification Tolerances: Record areas that are out of tolerance (greater than 1/4 inch in 8'-0" deviation in plane).

C. Inspect sheathing application for compliance with applicable requirement:

1. Glass-Mat-Faced Gypsum Sheathing of the specified manufacturer.

D. Report deviations from the requirements of project specifications or other conditions that might adversely affect the installation to the General Contractor.

3.4 SURFACE PREPARATION

A. Replace weather damaged sheathing and repair damaged or cracked surfaces.

B. Level surfaces to comply with required tolerances.

3.5 INSTALLATION

A. Accessory Installation

1. Install appropriate starter accessory.

2. Install appropriate casing bead accessories at system terminations (such as expansion or control joints, lights or vent strips, etc.) in accordance with locations indicated on architectural drawings. Maintain a gap of minimum 1/4" (6 mm) between the accessory and the abutment to form a sealant joint.

3. Follow accessory manufacturer's instructions for accessory butt joints to maintain water tightness.

4. Provide expansion joints in sheathing at minimum intervals of 30 feet (9.1 m) up to a maximum area of 900 square feet (82.8 m^2), wherever the system abuts

dissimilar construction or an existing joint occurs in construction. Fit sheathing snugly into accessories prior to attachment.

5. Fasten surface mount accessories (for example, casing beads and surface mount expansion joints) through the sheathing into framing at locations indicated on architectural drawings. Where necessary, level surfaces such as outside corners with appropriate leveling material to maintain plumbness and squareness.

B. Base Coat Application

1. Apply base coat over the sheathing with proper spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/16 inch (1.6 mm). Apply base coat in strips of 40 inches (1 m) and immediately embed reinforcing mesh into the wet base coat by troweling from the center to the edge of the mesh. Avoid wrinkles in the mesh. Overlap the mesh minimum 2-1/2 inches (64 mm) at mesh joints and stagger mesh overlaps minimum 8 inches (200 mm) from sheathing joints.

2. Where surface mount accessories are used, such as deep "V" expansion joint, overlap the mesh from the sheathing onto the perforated accessory flange (refer to details).

3. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Feather mesh overlaps to avoid reading the mesh through the finish coating. Allow base coat to thoroughly dry before applying primer or finish.

4. For soffit applications that will utilize a heavy texture finish coat to conceal minor surface irregularities, the full mesh may be deleted. Tape joints with a 6 inch (150 mm) wide strip of mesh embedded in base coat, then apply minimum 1/16 inch (1.6 mm) thick base coat over the entire surface of the sheathing. Feather the taped sheathing joints to avoid reading the joints through the finish coating.

C. Finish Coat Application

1. If a primer is used, apply with brush, roller or proper spray equipment over the clean, dry base coat and allow to dry thoroughly before applying finish.

2. Apply finish directly over the base coat (or primed base coat) ONLY AFTER THE BASE COAT/PRIMER HAS THOROUGHLY DRIED. Apply the finish by spraying, or troweling with a stainless steel trowel, depending on finish specified. General rules for application of finishes are as follows:

   a. Avoid application in direct sunlight.
   b. Apply finish in a continuous application, always working to a wet edge.
   c. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying and may require adjustments in the scheduling of work to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
   d. Do not install finish on accessories.

e. Float "R" (rilled texture) with a plastic trowel to achieve their rilled texture.
f. Do not install separate batches of finish side-by-side.
g. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the project specifications.

D. Sealant Installation: Seal all open joints in the system with appropriate sealant in accordance with sealant manufacturer's recommendations to prevent any water from getting into or behind the system.

3.6 CLEANING

A. Remove all masking materials and clean any materials that may have been deposited on surrounding area. Dispose of all containers, masking materials and other debris according to local, state, and federal regulations.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 072713

NON-PERMEABLE, SELF-ADHERED AIR/VAPOR BARRIER MEMBRANE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the non-permeable self-adhered air/vapor barrier membrane as shown on the drawings and/or specified herein.

1.3 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 pounds per square foot) (0.02 liters per second per square meter at 75 Pascals) when tested according to ASTM E 2178, and a vapor permeance of 0.1 perms or less when tested according to ASTM E 96.

B. Assembly Performance: Provide a continuous air and vapor barrier assembly that has an air leakage not to exceed 0.040 cubic feet per square foot per minute under a pressure differential of 0.3 in. water (1.57 pounds per square foot) (0.20 liters per second per square meter at 75 Pascals) when tested in accordance with ASTM E 2357. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions.

1. Assembly shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure.

2. Assembly shall not displace adjacent materials under full load.

3. Assembly shall be joined in an airtight and flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep, and anticipated seismic movement.

C. Connections to Adjacent Materials: Provide connections to prevent air leakage and vapor migration at the following locations:

1. Foundation and walls, including penetrations, ties and anchors.

2. Walls, windows, curtain walls, storefronts, louvers or doors.

3. Different wall assemblies, and fixed openings within those assemblies.

4. Wall and roof connections.

5. Floors over unconditioned space.

6. Walls, floor and roof across construction, control and expansion joints.

7. Walls, floors and roof to utility, pipe and duct penetrations.

8. Seismic and expansion joints.

9. All other leakage pathways in the building envelope.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data, manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.

2. Include statement that materials are compatible with adjacent materials proposed for use.

3. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

B. Samples: Submit clearly labeled samples, 6" x 6" minimum size of each material specified.

C. Shop Drawings of Mock-Up: Submit shop drawings of proposed mock-ups showing plans, elevations, large-scale details, and connections to the test apparatus.

D. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.

E. Shop Drawings: Submit shop drawings showing locations and extent of air and vapor barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the air and vapor barrier are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

F. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning

materials used during installation are chemically compatible with adjacent materials proposed for use.

1.5 QUALITY ASSURANCE

A. Air Barrier Contractor Qualifications: Contractor must have a minimum 3 years' experience with specified materials on projects of similar size and scope.

B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

E. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

F. Do not cover air and vapor barrier membrane until it has been inspected, tested and accepted.

G. Mock-Ups: Build mock-up representative of primary exterior wall assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Commissioner. Mock-up shall be approximately 8 feet long by 8 feet high and include all components in the exterior wall assembly.

H. Mock-Up Tests for Air and Water Infiltration: Test mock-up for air and water infiltration in accordance with ASTM E 1186 (air leakage location), ASTM E 783 (air leakage quantification), and ASTM E 1105 (water penetration). Use smoke tracer to locate sources of air leakage. If deficiencies are found, reconstruct mock-up and retest until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.

1. Perform the air leakage tests and water penetration test of mock-up prior to installation of insulation board cladding and trim but after installation of all masonry anchors and fasteners for cladding and trim and after installation of other penetrating elements.

2. ASTM E 1186: No visible air leakage.

3. ASTM E 783: Less than 0.04 cfm/sf at 0.3 in. of water over mock-up area. For these tests, air leakage through the window-to-wall interface is considered, but air

leakage though the window unit itself is not (window unit should be covered during tests).

I. Mock-Up Tests for Membrane Adhesion: Perform a qualitative test by cutting a 6" x 6" square in the membrane. If the membrane cannot be peeled back by hand without tearing or stretching the membrane, the adhesion is adequate.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air and vapor barrier membrane manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with manufacturer's recommendations.

1.7 PROJECT CONDITIONS

A. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer. Do not apply air and vapor barrier to a damp or wet substrate or where ambient or surface temperatures are above 40 deg. F.

B. Field Conditions: Do not install air and vapor barrier in snow, rain, fog, or mist. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

1.8 WARRANTY

A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum 5 years from date of Substantial Completion.

B. Installation Warranty: Provide installer's 2-year warranty from date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 PRODUCTS

2.1 VAPOR BARRIER AND MEMBRANES (BASIS OF DESIGN)

A. Provide product listed below manufactured by the Henry Company or equivalent by W. R. Grace ("Perm-A-Barrier"), or Carlisle ("CCW-705") or approved equal.

1. Sheet Applied Air/Vapor Barrier: Blueskin SA with primer (LVC adhesive) (over new exterior gypsum board sheathing walls and roof at new addition – but not limited to).

2. Fluid Applied: Air Bloc 21 FR (over all CMU back up for new addition brick veneer and sealed around masonry anchors – but not limited to).

a. Provide Air Bloc 21 for adhering extruded polystyrene insulation.

3. Transition Membrane: Blueskin SA and Blueskin SA LT for low-temperature applications.

4. Sheet-Applied, High-Temperature-Rated Roof Underlayment: Blueskin PE-200 HT (over roof deck board and exterior gypsum board sheathing for zinc panel clad roofs and walls).

5. Water-Based Primer for Transition Membrane: Aquatec Primer.

6. Solvent-Based Primer for Transition Membrane: Blueskin Adhesive.

7. Solvent-Based Aerosol Primer for Transition Membrane: Blueskin Spray Prep.

8. Counterflashing for Masonry Through-Wall Flashing: Blueskin TWF.

9. Mastics, Adhesives and Tapes: Henry 570-05 Polybitume.

2.2 AUXILIARY MATERIALS

A. Membrane at Transitions in Substrate and Connections to Adjacent Elements: Neoprene, ASTM D 2000 Designation 2BC415 to 3BC620, 50 to 65 mils (1.3 mm to 1.6 mm) thick with non-corrosive termination bars and fasteners. Adhesive and lap sealant as recommended by manufacturer.

B. Sealant at Transitions in Substrate and Connections to Adjacent Elements: Low-modulus pre-cured silicone extrusion and sealant for bonding extrusions to substrates; Tremco Silicone Extruded Sheet by Tremco, Proglaze ETA by Tremco, Bondaflex Silbridge 300 by May National Associates, or approved equal.

C. Transition Membrane Between Air and Vapor Barrier and Adjacent Conditions - Parapets and Horizontal Top of Wall Terminations: Self-adhering, high-temperature roof underlayment, SBS-modified rubberized asphalt compound laminated to a polyethylene film.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.

1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected. Starting of work means acceptance of substrate.

2. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.

3. Ensure that the following conditions are met:

a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
b. Concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.

4. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test.

5. Notify Commissioner in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Ensure clean, dust-free, and dry substrate for air and vapor barrier application.

1. Prime masonry, concrete substrates with conditioning primer.

2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.

3. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.

3.3 INSTALLATION

A. Self-Adhering Sheet Air and Vapor Barrier: Install membrane to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and the following:

1. Apply primer at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application. Apply as many coats as necessary for proper adhesion. Do not apply primer below 25 deg. F.

2. When membrane is properly positioned, press into place and roll membrane with roller immediately after placement.

3. Apply membrane sheets to shed water naturally without interception by a sheet edge, no reverse laps are permitted.

4. Position subsequent sheets of membrane applied above so that membrane overlaps the membrane sheet below by a minimum of 3 inches, unless greater overlap is recommended by manufacturer. Roll into place with roller.

5. Overlap horizontally adjacent pieces a minimum of 3 inches, unless greater overlap is recommended by manufacturer. Roll seams with roller.

6. Seal around all penetrations with termination mastic, liquid membrane, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.

7. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations and the project details.

8. At changes in substrate plane, provide transition material (bead of sealant, membrane counterflashing, liquid membrane or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another. Transition material must be fully cured prior to membrane application.

9. As shown on drawings, provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Metal sheet shall be continuously supported by substrate.

10. At through-wall flashings, provide an additional 6-inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane. Seal exposed top edge of strip with bead of mastic as recommended by manufacturer.

    a. The through wall flashing shall be integrated with the wall membrane. A strip sealing the top edge of the flashing shall have its own exposed top.

11. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement. Membrane shall be designed to avoid adhesion over the joint and allow for free movement.

12. At expansion and seismic joints provide transition to the joint assemblies.

13. At end of each working day, seal top edge of membrane to substrate with termination mastic.

14. Do not allow materials to come in contact with chemically incompatible materials.

15. Do not expose membrane to sunlight longer than as recommended by the manufacturer.

16. Inspect installation prior to installing insulation enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Inspection and Testing: Cooperate with testing agency. Allow access to work areas and staging. Notify testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted.

3.5 PROTECTING AND CLEANING

A. Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Coordinate with installation of materials which cover air and vapor membrane, to ensure exposure period does not exceed that recommended by the air and vapor barrier manufacturer.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION

SECTION 073360

VEGETATED ROOFING SYSTEM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish, plant and install the green roof assembly (hot-applied) complete as shown on the Drawings and as specified herein.

1. The complete green roof assembly shall be warranted by a single source as an integrated design system for the complete term as specified herein.

1.3 RELATED SECTIONS

A. DDC General Conditions

B. 033000 – Cast-In-Place Concrete.

C. 034500 – Architectiral Precast Concrete.

D. 062000 – Finish Carpentry

E. 079200 – Caulking and Sealants

1.4 REFERENCES

A. ASTM C67– Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM C131– Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. ASTM C208 – Standard Specification for Cellulosic Fiber Insulating Board.

D. ASTM C 311, Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

E. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

F. ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

G. ASTM C928– Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.

H. ASTM C1177/C1177M – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

I. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

J. ASTM D41– Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

K. ASTM D93– Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.

L. ASTM D140 – Standard Practice for Sampling Bituminous Materials.

M. ASTM D412– Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.

N. ASTM D621 – Test Methods for Deformation of Plastics Under Load.

O. ASTM D698– Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

P. ASTM D816– Standard Test Methods for Rubber Cements.

Q. ASTM D1475– Standard Test Method For Density of Liquid Coatings, Inks, and Related Products.

R. ASTM D1621– Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.

S. ASTM D1644– Standard Test Methods for Nonvolatile Content of Varnishes.

T. ASTM D1875– Standard Test Method for Density of Adhesives in Fluid Form.

U. ASTM D1876– Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).

V. ASTM D2842 – Standard Test Method for Water Absorption of Rigid Cellular Plastics.

W. ASTM D3278– Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus.

X. ASTM D3960– Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

Y. ASTM D4716 – Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

Z. ASTM D6511– Standard Test Methods for Solvent Bearing Bituminous Compounds.

AA. ASTM D6754– Standard Specification for Ketone Ethylene Ester Based Sheet Roofing.

BB. ASTM E108 – Standard Test Methods for Fire Tests of Roof Coverings.

CC. ASTM C140– Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

DD. ASTM D448– Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

EE. ASTM D5036– Standard Practice for Application of Adhered Poly(Vinyl Chloride) Sheet Roofing.

FF. Standard Practice ACI 226.R1, Ground Granulated Blast-Furnace Slag as a Cementitious Constituent in Concrete. US EPA Standard 40 – Worker Protection Standards for Agricultural Pesticides.

GG. US EPA 600/R13/116 – Method for the Determination of Asbestos in Bulk Building Materials.

HH. ASTM E2396-05 - Standard Test Method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Green Roof Systems; 2005.

II. ASTM E2397-05 - Standard Practice for Determination of Dead Loads and Live Loads associated with Green Roof Systems, 2005.

JJ. ASTM E2398-05 - Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Green Roof Systems, 2005.

KK. ASTM E2399-05 - Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems, 2005.

LL. ASTM E2400-06 Standard guide for selection, installation, and maintenance of plants for green roof systems.

1.5 DEFINITIONS

A. Vegetated Roof: An area of planting and landscape, built up on a waterproofed substrate at any level that is separated from the natural ground by a man-made structure.

B. Vegetated Roof System: The complete system of materials (from concrete topping up to vegetation) that functions to provide a watertight protected membrane and an Extensive or Intensive vegetated roof design to assist in storm water management, energy conservation and a long-term life-cycle expectation.

C. Extensive Vegetated Roof: Low to no maintenance landscaping consisting of shallow soil depths (<6 inches) with plant varieties that are restricted primarily to mosses,

herbs, low-growing succulents and perennials, and grasses that can withstand harsh conditions and are indigenous to the area of planting.

D. Intensive Vegetated Roof: Landscaping requiring regular maintenance, consisting of deeper soil depths (>6 inches) with a wider variety of plant species possible including shrubs and small trees.

1.6 PROJECT CONDITIONS

A. Application of the membrane and vegetated roof system shall not commence nor proceed during inclement weather. All surfaces to receive the membrane and vegetated roof system shall be free of water, dew, frost, snow and ice.

B. Application of membrane shall not commence nor proceed when the ambient temperature is below 0°F (-17.7°C).

C. Preparation and application of membrane shall be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180°F (82°C) (i.e., hot pipes and vents or direct steam venting, etc.).

E. Contractor and Roofing Contractor shall consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roof membrane. Any exposure to foreign materials or chemical discharges must be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.

G. Cast-in-place concrete and precast concrete deck surface conditions shall be approved by the On-site technical representative of the Membrane Manufacturer.

H. Contractor shall assure that protection is provided to the membrane and vegetated roof system after installation so other trades do not damage membrane.

I. Plants shall not be installed when weather is excessively hot or cold, or during rain events.

1.7 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roof Membrane Design: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

D. Factory Mutual: comply with FM 1-35 (September 2006) standard for Green Roof Systems.

1. FMG Membrane Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4470 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

   a. Note: There are currently no FM approved vegetative assemblies.
   b. Contractor is required to conduct a low vector mapping non-destructive testing.

2. Use insulation with adequate compressive strength designed to support all dead and live loads installed above the insulation layer.

   a. Reference ASTM E 2397-05.

3. Loading requirements:

   a. Live loads for people access require min 100 lbs. per sq. ft.
   b. Allow for future loads incorporating an additional 15% by weight of the growing media. Note that loose laid membranes require min. 8" depth of growing medium. Safety factor 1.7

4. Non-roofing vegetative accessories can be ballasted with soil. Safety factor 0.85

5. Vegetative matter requiring anchoring a min. of one growing season. Safety factor 1.0

E. Flashings: Comply with requirements of Division 7 Section "Sheet Metal Flashing and Trim." Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations of the following:

1. FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings.

2. NRCA Roofing and Waterproofing Manual (Fifth Edition) for construction details and recommendations.

F. Vegetated roof components: Provide vegetated roof system that properly conveys water to roof drains, does not damage waterproofing systems, and allows for plant growth and long-term survival.

1.8 SUBMITTALS

A. Any Substitution must also comply with the LEED requirements listed for the specified item.

B. Product Certificate: Submit notarized certificate, indicating complete list of products intended for use under Work of this Section, including product names and numbers and

manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.

C. Product Data: For each type of roofing material indicated.

D. Shop Drawings (if the installation details differ from the architectural drawings): Show locations and extent of roofing. Include plans, sections, details, and attachments to other Work, for substrate joints and cracks, flashing sheets, roof penetrations, vertical intersections, roof slope, expansion joints, and membrane terminations.

1. Show locations, extent, and details of roof pavers.

E. Submit a letter signed by the manufacturer and Contractor acknowledging that the submitted roof membrane design complies with ASCE-7 for wind speed code requirements.

F. Samples for Verification: For each of the following products:

1. 12-by-12-inch squares of base membrane, reinforcement sheet, protection board, (root barrier) and flashing sheet.

2. 12-by-12-inch square of board insulation.

3. 12-by-12-inch square of filter fabric.

4. 12-by-12-inch square of drainage board with filter fabric.

5. Engineered soil, 1 cubic foot minimum.

6. Drain rock, 1 cubic foot minimum.

7. Edge Restraint, 2 linear feet minimum.

8. Precast Pavers, 2 linear feet for each type of material.

9. Plants, two of each species minimum.

10. Drip irrigation tubing, 2 linear feet minimum.

G. Product technical data sheets for all sample materials.

H. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

I. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Product Compatibility: Indicate manufacturer has verified compatibility of roofing system components, including but not limited to: Roofing base and ply sheets, membrane backer and flashing sheets, reinforcement fabric felts and mats, adhesives, mastics, coatings, and sealants.

2. Adhesive Flammability: Indicate manufacturer has verified cold process adhesives and coatings are non-flammable.

J. Qualification Data: For Installer, manufacturer, and field technical inspector per Section 1.6 - "Quality Assurance".

K. Project Closeout Reports: Provide a report upon delivery of the project warranty. This report to include:

1. Project Specifications.

2. Project Summary.

3. Progress reports as a result of roof inspections.

4. Job-site progress photos.

5. Warranty document.

6. Owner's Manual describing maintenance and emergency repair procedures.

L. Maintenance Data and Training Materials for roofing system.

M. LEED SUBMITTALS REQUIREMENTS

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 LEED Certification Requirements). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the

submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

5. LEED submittals are required for all installed materials in specification Divisions 2 through 12 and adhesives, sealants, and paints through Division 16.

1.9 LEED PERFORMANCE REQUIREMENTS

A. Products used in this section shall contain recycled content, wherever possible.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Section 01302, Part 2, where applicable.

1.10 QUALITY ASSURANCE

A. Special experience Requirements (SER)

1. Manufacturers:

a. The manufacturer providing the material or equipment specified in this section must, for the past five (5) years have been regularly engaged in the manufacturer of material or equipment similar in type to that required for this Project, Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years.

2. Installers

a. The contractor or subcontractor performing the work of this section must be a company regularly engaged in performing roofing projects with its own workforce and have successfully completed in a timely fashion at least three (3) roofing projects similar in scope, size and type to the required work within the last three (3) consecutive years prior to the bid opening. At least one of those projects must have been performed within the last twelve (12) months. The three (3) qualifying projects must have utilized one or more of the roofing systems specified for the project being bid herein, been installed by the contractor's or subcontractor's company utilizing its own workforce and must have qualified for, and have been issued, the warranty provided by the manufacturer of the roofing system. In addition, the contractor or subcontractor must be a certified or authorized installer for at least one of the manufacturer's roofing systems specified herein and shall submit proof of same.

B. Manufacturer Qualifications: A qualified manufacturer that has UL listing and FMG approval for roof membrane system identical to that used for this Project.

1. Manufacturer shall Be ISO 9001 registered.

C. Technical Inspector Qualifications: An authorized full-time employee representative of manufacturer experienced in the installation and maintenance of the specified roofing

system membrane and qualified to determine Installer's compliance with the requirements of this Project or a manufacturer approved Registered Roof Observer as certified by the Roof Consultants Institute.

1. Technical Inspector must provide full-time inspections each and every week during the complete installation process and provide a written and photographic report to the Contractor for submittal to the Commissioner.

2. A day is defined as a minimum of seven (7) hours of inspection and testing per working day.

3. The presence and activity of the technical inspector shall not relieve the contractor of contractual responsibilities or duties.

D. Verification of Growing Media Design

1. Provide Growing Media Blender verification reports from each batch mix to the on site technical inspector and designer for inclusion in the job report.

2. These verification reports shall list the actual percentages of media components.

3. The intent is to verify proper media design is being delivered to the project site.

E. Protection of Installed Materials

1. Against Loads: Protect existing structure and work of this section against concentrated loads and any other loads or equipment that would cause damage. Use boards or other approved means to safely distribute the loads.

2. Against Traffic: Do not permit traffic on areas of this section except for workmen doing the work during installation, until covered with protective boards or with specified finish materials. Take necessary preventative measures to protect work of the section from damage during and after application, until traffic is permitted.

3. Rejection of Damaged Work

   a. Damaged materials or work will be rejected.
   b. Rejected materials or work must be immediately removed and replaced with new materials at the contractor's expense.

F. Conform to NRCA Roofing Specifications and roofing membrane manufacturer's instructions.

G. Source Limitations: Obtain complete roof system materials through one or more sources from manufacturers specializing in green roofing systems.

H. Fire-Test-Response Characteristics: Provide roof membrane with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated.

I. Project Meetings: Comply with requirements for pre-installation conferences in General Conditions.

1. Pre-Construction Conference

   a. General: Before starting roof deck construction or re-roofing preparation, conduct conference at Project site. Comply with requirements for pre-installation conferences in General Conditions. Review methods and procedures related to roof deck construction or re-roofing preparation and roofing system are as follows:
      1). Pre-construction meeting will be scheduled by the Commissioner after notice of award.
      2). Participants: Commissioner, General Contractor, Manufacturer/ warranty issuer, and Third Party Inspectors (if required).
      3). Agenda shall include the following: Review of submittal list of subcontractors, materials and progress schedule. Designation of responsible personnel. Walkover inspection. Review of the building and grounds. Review the scope of work. Review manufacturers' installation standards. Review of the environmental and atmospheric plan.

2. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roofing system including, but not limited to, the following:

   a. Participants: Authorized representatives of the City of New York, Construction Manager, Commissioner, Consultant, General Contractor, Roofing Subcontractor, Roofing Manufacturer, and installers of roof components/accessories and roof-mounted equipment shall attend the pre-installation meeting.
   b. Review methods and procedures related to roofing installation, including manufacturer's written installation instructions.
   c. Review construction schedule and confirm availability of Products, Subcontractor personnel, equipment and facilities.
   d. Review deck installation criteria and finishes for conformance with roofing system criteria, including issues of flatness and fastening.
   e. Review structural loading conditions and limitations of roof deck both during and after roofing application.
   f. Review flashing details, special roofing details, roof drainage, roof penetrations, equipment curbs, and other conditions affecting roofing installation.
   g. Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
   h. Review safety requirements, including temporary fall-arrest measures.
   i. Review field quality control procedures.

3. Progress Meetings

a. General: Review methods and procedures related to roofing system as follows:
   1). Progress meetings shall be scheduled by the General Contractor.
   2). Participants: Commissioner/City of New York's representative, Consultants, General Contractor, Roof Sub-contractor, Manufacturer, Third Party Inspector (if required).
   3). Agenda shall include the following: Review of work progress, inspection findings of partial install. Approvals prior to next work. Maintenance of progress schedule. Maintenance of quality and work standards. Review of the building and grounds. Review of the scope of work.

4. Final Inspection

a. General: Review methods and procedures related to roofing system as follows:
   1). Final Inspection shall be scheduled by General Contractor upon completion.
   2). Participants: Commissioner/City of New York's representative, Consultants, General Contractor, Roof Sub-contractor, Manufacturer, Third Party Inspector (if required).
   3). Agenda shall include the following: Walkover inspection. Identification of problems, which may impede issuance of warranty.

J. Random Sampling

1. During course of work, the Commissioner may secure samples according to ASTM D140-93 of materials being used from containers at job site and submit them to an independent laboratory for comparison to specified material.

2. Should test results prove that material is not equal to specified material:

   a. Contractor shall pay for all testing.
   b. Roofing installed and found not to comply with the specifications shall be removed and replaced at no additional cost to the City of New York.

3. Review roof observation and repair procedures after roofing installation.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Refer to manufacturer recommendations.

B. Delivery

1. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

2. Deliver plants when site conditions are adequate to receive work; protect items from weather while in transit. Deliver materials in a timely manner to ensure uninterrupted progress of the work.

C. Storage of Materials

1. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

   a. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

2. Store materials marked "keep from freezing" in areas where temperatures will remain above 40 degrees Fahrenheit.

3. For insulation, remove plastic packaging shrouds. For felt rolls, slit the top of the plastic shrink-wrap only. Cover top and sides of all stored materials with tarpaulin. Secure tarpaulin. Store in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

4. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces.

5. Do not double-stack rolls.

6. Rooftop storage: Disperse material to avoid concentrated loading.

7. Materials may not be stored without a canvass tarpaulin, or on direct contact with the ground or roof surface. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 degrees F (10 degrees C).

8. Store plants out of direct sunlight.

9. Should Contractor be required to quickly cover material temporarily, such as during an unanticipated rain shower, all materials shall be stored on a raised platform covered with secured canvas tarpaulin, top to bottom.

10. Contractor is responsible for the safekeeping of materials stored onsite.

D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

E. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.12 PROJECT CONTITIONS

A. Application of the membrane and vegetated roof system shall not commence nor proceed during inclement weather. All surfaces to receive the membrane and vegetated roof system shall be free of water, dew, frost, snow and ice.

B. Application of membrane and installation of plants shall not commence nor proceed when the ambient temperature is below 0°F (-17.7°C).

C. Preparation and application of membrane shall be conducted in well ventilated areas.

D. Over its service life, do not expose membrane or accessories to a constant temperature in excess of 180°F (82°C) (i.e., hot pipes and vents or direct steam venting, etc.).

E. Contractor and Roofing Contractor shall consult container or packaging labels and Material Safety Data Sheets (MSDS) for specific safety information.

F. Do not allow waste products (petroleum, grease, oil, solvents, vegetable or mineral oil, animal fat, etc.) to come in contact with the roof membrane. Any exposure to foreign materials or chemical discharges must be presented to membrane manufacturer for evaluation to determine any impact on the roof membrane assembly performance.

G. Cast-in-place concrete and precast concrete deck surface conditions shall be approved by the On-site technical representative of the Membrane Manufacturer.

H. Contractor shall assure that protection is provided after installation so other trades do not damage membrane.

1.13 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the City of New York of other rights the City of New York may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. The Warrantor or their representatives must, during the second, fifth, tenth and fifteenth year of the warranty, inspect and provide a written Executive Summary.

1. Vegetated Roof System Complete Assembly Warranty:

a. System Warranty: covers components of the green roof assembly, including membrane, flashings, root barrier, filter fabric, drainage mat, insulation, and termination details.
1). Duration of membrane/flashing: 20 year (watertight condition)
(a). Wind speeds not to exceed 70 mph at any time.
2). Duration of insulation: 20 year 80% of original thermal value.

b. Plant Establishment Warranty on growing media and plantings are covered separately under the terms of the warranty agreement, if purchased from the Warrantor. The Warrantor will not warrant growing media and plant materials not purchased through the Warrantor.
1). Extensive type plantings

(a). Duration of Warranty: Up to 2 years

(b). The Warrantor guarantees that plants selected, approved and provided by the Warrantor or its certified representatives will propagate from the initial planting, and plantings will be alive, growing and cover the planted roof area at an approximate minimum rate of: 50% coverage after one full year; 75% coverage after two full years; and 85% coverage after three full years.

2). Ornamental plants

(a). Duration of Warranty: 2 growing season

(b). The Warrantor guarantees that Ornamental plants (trees and shrubs) selected, approved and provided by the Warrantor or their certified representatives will establish from the initial planting, so that one growing season from planting, 80% of the initial planted materials will be alive. Trees shall carry the pass-thru warranty from the nursery and will not include any placement costs.

c. Inspections, Preventative Roof Maintenance and Establishment:

1). Roof inspection services are as follows:

(a). Visual inspection of the rooftop surface conditions.

(b). Inspection of the exposed flashing systems including, but not limited to, the metal edge system, base flashings on equipment and adjoining walls, counterflashing and termination details, drains, soil stacks and vents, and HVAC equipment, sky lights and access hatches.

2). Preventive roof maintenance services are as follows:

(a). Flashing components – tears, splits and breaks in the exposed membrane flashings will be repaired with appropriate mastics and membranes.

(b). Exposed fasteners will be sealed. Termination bar and counterflashings will be sealed.

3). Plant and Growing Media establishment services are as follows:

(a). Removal of all plantings that have not successfully established, performed twice annually each of the first two years. All debris will be legally disposed of at the City of New York's approved on-site location. Debris left by other trades or the City of New York is not included.

(b). Weeding of invasive plant species will be conducted twice annually, each of the first two years. Additional weeding desired by the City of New York will be at an additional per trip cost.

(c). Fertilizer, if required, will be completed once per year.

(d). Replacement of dead plant material, as required, to meet the prescribed coverage rates will be included. Plant materials destroyed through acts of negligence, City of New York modifications, wind events greater than 50mph or other acts of God, are not covered.

(e). Compaction of growing media is not covered under the terms of the establishment agreement. To avoid this problem, an additional 15% of the required volume of growing medium shall be installed. If compaction occurs and the City of New York desires additional placement of material, this will be provided on an additional cost basis.

d. The Warrantor shall provide roof inspection reports based upon regular inspections as defined above.

1.14 PRECONSTRUCTION CONFERENCE

A. Pre-Construction Conferences. The Contractor, Roofing Contractor, Engineer, City and the Manufacturer will meet at the job site to review and discuss schedule, installation, flood testing/acceptance criteria and actual project conditions as it relates to the integrity of the roofing assembly. Prior to beginning the work. Contractor shall notify all parties at least one (1) week prior to the meeting.

B. Contractor to coordinate and verify all roof penetrations are completed and grouted solid prior to membrane installation.

C. Contractor to communicate and coordinate schedule of roofing/ waterproofing installation with other trades.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Tremco Inc., Beachwood, Ohio (basis of design)

B. American Hydrotech, Inc., Chicago, IL

C. Or approved Equal

2.2 COLD-APPLIED ROOF AND FLASHING BASE MEMBRANE (WATERPROOF MEMBRANE)

A. Ply Sheet and Flashing Backer Sheet: Tremco, BURmastic (or equal) Glass Ply-28 lb.: ASTM D 4601, Type II, non-perforated, asphalt-impregnated and coated glass-fiber sheet dusted with fine mineral surfacing on both sides, with the following properties:

1. Breaking Strength, minimum, ASTM D 146: machine direction, 90 lbf/in cross direction, 70 lbf/in.

2. Pliability, ½ inch radius bend, ASTM D 146: No failures.

3. Net Dry Mass, minimum, ASTM D 228: 28.0 lb/100 sq. ft.

4. Asphalt, minimum, ASTM D 228: 7.0 lb/100 sq. ft.

2.3 CAP MEMBRANE (ROOT BARRIER)

A. Cap Sheet: (TPA) Sheet; ASTM D 6754, reinforced with a high strength wick resistant polyester fabric and fleece backed for field membrane and flashings, so it can be hot adhered to the base membrane.

1. Performance requirements:

a. Membrane Thickness: 45 mils, nominal.
b. Exposed Face Color: White.

2.4 COLD-APPLIED TPA ADHESIVE MATERIALS

A. Cold-Applied Adhesive: Tremco, BURmastic Adhesive: One-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with specified roofing membranes and flashings, with the following physical properties:

1. Asbestos Content, EPA 600 R-93/116: None.

2. Volatile Organic Compounds (VOC), maximum, ASTM D 6511: 340 g/L.

3. Nonvolatile Content, minimum, ASTM D 6511: 67 percent.

4. Flash Point, minimum, ASTM D 93: 100 deg F.

5. Density at 77 deg F, ASTM D 6511: 8.4 lb/gal.

6. Uniformity and Consistency, ASTM D 6511: Pass.

B. TPA Membrane Bonding Adhesive: Tremco TPA/WB non-flammable, asbestos free, water-based bonding adhesive for fleece backed membrane.

C. TPA Flashing bonding Adhesive: Tremco TPA/LV low VOC, asbestos free, solvent based adhesive for non-fleece backed flashing membrane.

2.5 EXPANSION JOINT

A. Provide FlamLINE Waterproof Expansion Joint as manufactured by Situra, Inc. or approved equal.

2.6 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum termination bars, approximately 1 by 1/8 inch thick with anchors.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

D. Accessories: Manufacturer's recommended protection course, backer rods, sealants, and other accessories.

E. Low-VOC Asphalt Primer:

1. Asbestos Content, EPA 600 R-93/116: None.

2. Non-Volatile Content, minimum, ASTM D 1644: 60 percent.

3. Volatile Organic Compounds, maximum, ASTM D 3960: 350 g/L.

4. Flash Point, minimum, ASTM D 3278: 100 deg. F.

5. Density at 77 deg. F, minimum, ASTM D 1475: 7.8 lb/gal.

F. Stainless Steel Flashing:

1. Pre-Engineered Metal Coping System with no exposed fasteners.

a. Single source coping system manufacturer to provide all components including pre-fabricated corners and end caps.
1). System must carry a Factory Mutual rating of 1-180
b. Exposed materials shall be 24ga steel coated with Kynar 500 / Hylar 5000 fluorocarbon base top coat applied over a quality matched primer, with the same primer and a wash coat on the back side for additional protection.
c. Structural support components:
1). Cleats: minimum 12 inch long by 16ga galvanized steel.
(a). Attach and space per FMG 1-49
2). Support spring: minimum 26 ga galvanized steel

G. Other Metal Flashings:

1. All flashing metal that contacts TPA sheet will be TPA coated metal, so flashing sheet can be welded to metal flashings.

2. Metal flashings, counter flashings, pitch pans, scuppers, and like applications shall be in accordance with:

a. National Roofing Contractors Association Manual (NRCA).

3. Counter flashing and other visible sheet metal flashing:

a. Stainless Steel: pre-painted.
1). Paint finish at exposed side: Factory applied baked-on two (2) coat system comprised of one (1) coat of full 70% resin fluorocarbon by Kynar 500 or accepted substitute over a smooth coat of corrosion-

resistant epoxy-based primer. Color as selected by City of New York.

b. Finish at underside shall be a wash coat over a coat of corrosion-resistant epoxy-based primer.

H. Miscellaneous Accessories: Provide pour-able sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain under the membrane as required. Fabricate to slopes indicated.

2. Asphalt Mastic: An asphalt-based, heavily fibrated, asbestos free mastic.

3. Flashing Tape: A flexible, non-drying, butyl-based, gasket-forming sealant tape.

4. Pitch Pan Cement: ASTM C 928-89, rapid hardening non-shrink grout.

5. Metal Joint Sealant: An asbestos free, one-part, low modulus moisture curing, silicone sealant.

6. Reglet Joint Sealant:

a. One-part, bituminous polyurethane sealant.
b. Joint Sealant.

7. Primer:

a. An asbestos-free, modified water-based asphalt primer
b. Primer

I. Foam Insulation: Insulfoam GF EPS15 or approved equal.

2.7 ELECTRIC FIELD VECTOR MAPPING SYSTEM

A. General: Provide a leak detection system that delivers a pulsating low voltage potential difference between the roof surface and the structural deck. The system is designed to detect a breach in the roof membrane system by detecting an electrical connection.

B. The wire component of the system shall remain on the roof membrane and buried in the system, so that future leak detection tests are possible.

C. Basis of Design Product, International Leak Detection.

1. Other manufacturers include:
a. Honza Group Incorporated
301.953.7210
b. Detec Electronic Leak Detection
855-753-3832

c. Or approved equal.

2.8 FILTER FABRIC

A. Filter fabric: Polymat VR; Woven or non-woven polypropylene, polyolefin, or polyester fabric mat; water permeable and resistant to UV-light degradation; of type and weight recommended by insulation manufacturer for application.

2.9 INSULATION (RIGID INSULATION)

A. Board Insulation: ASTM C 578; extruded polystyrene, of type, minimum density, and minimum compressive strength indicated below; fabricated with rabbeted edges and with one side having ribbed drainage channels:

1. Compressive strength shall be determined by total design load.

a. Type VII, 2.2 lb/cu. ft. and 60 psi.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Board Insulation:

a. Dow Chemical Company (The).
b. Owens Corning.

2.10 DRAINAGE MAT

A. Pre-fabricated Drainage Course: A composite drainage system consisting of high compressive strength polystyrene plastic core laminated between 2 geotextile fabrics for use with extensive and semi-intensive designs of soil depths up to 18 inches.

1. Water Retention Capacity; 0.11 gal/sf

2. Flow Rate @ gradient = 1.0; 100 gpm/sf width per ASTM D 4716

3. Flow Rate @ gradient = 0.1; 21 gpm/sf

4. Drainage Layer Thickness; 1 inch

5. Compressive Strength; 9,500 lbs/sf, per ASTM D 1621

B. Accessories

1. Inspection Box; Aluminum housing with removable ventilated top and flange base. Access opening: 12" by 12"; Flange: 18" by 18"; Height: 6".

2. Perforated Metal Edge Restraint; Tremco Edge Restraint VR; 1/8" aluminum "L" shape with slotted openings for water drainage.

3. Adhesive tape for fabric joints; Tremco Para JT Tape.

2.11 GROWING MEDIA

A. Extensive Growing Media Components:

1. Vegetated planter assembly for lightweight, manufactured soil mixture designed for extensive type green roof systems. The soil shall consist of a blend of mineral and organic components complying with these ingedients.

a. Norlite or equal 3/8 " Expanded Shale Aggregate 4x0
b. USGA Root Zone Sand
c. WECare Compost

B. Extensive Growing Media Components:

1. Sand meeting the following criteria:

Sieve Size	Percent Passing By Weight	
	Minimum	Maximum
9.5 mm	100	
4.75 mm	90	100
2.36 mm	75	100
1.18 mm	50	85
600 µm	25	60
300 µm	10	30
150 µm	1	10
75 µm (Wet)	0	3

C. Growing Media Performance Characteristics -

Maximum Media Density: 80-70 lbs per cubic foot as maximum saturated density as measured by ASTM E 2399,
Total Organic Matter: 4-8% (Loss on Ignition Method).
pH (RCSTP): 6.5-7.7
Soluble Salts (DPTA saturated paste extraction): $\leq$ 5 mmhos/cm
Silt and Clay Percentage of Final Soil: Not to exceed 15% in total by weight
Fines: no more than 10% passing No. 200 sieve (.075m) ASTM 1632
Ksat Permeability (in/hr): < 1.4 inches per hour
Air Content at Maximum Water Capacity: $\geq$ 30%
Organic Amendment: approved soil shall demonstrate compost as the organic matter amendment and that compost must demonstrate involvement in the US

D. Mixing Procedure

1. Green roof extensive media is to be mixed by an approved blender only.

a. Compost and USGA sand blending:
1). Mechanically mix 1 part sand to 1 part compost to provide a uniform distribution of the components.

2). Inadequate moisture content: Do not work planting medium when moisture content is low enough that dust will form in the air.

3). Do not work planting medium when the moisture content is high enough that excessive compaction will occur. Aerate planting medium until moisture content is uniformly reduced as necessary to achieve optimum compaction.

b. Final mixing of Intensive Media with expanded slate:

1). Saturate the expanded slate blend with water to ensure proper soil distribution.

2). Mechanically mix 3 parts of the sand/compost blend with 7 parts of the wetted blend until a uniform distribution of the components is achieved.

3). When stockpiling the finished mix, cover the pile with a plastic tarp to prevent drying out or soil separation from the rain.

E. Media Placement

1. Place extensive growing media with approved equipment and protect all other materials from damage during installation.

2. Pre-settlement: Preset the media by thoroughly watering the entire planting area.

3. Fill settled low areas with the media and repeat the compaction and filling process until settlement ceases.

F. Protection of Soil Mixes

1. Contamination and Compaction

a. Do not deliver or place soils in frozen, wet, or muddy conditions. Material should be at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Do not place materials in an excessively moist condition.

b. When stockpiled, protect soils media from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced into the material after stockpiling, allow material to drain or aerate to optimum compaction moisture content.

c. In handling materials, operating tools and equipment, protect the media from compaction by laying down planking or plywood as required for protection.

d. Pressure wash equipment prior to handling media to prevent weed seed contamination.

G. Quality Control: Quality control sample shall be collected per 1000 cubic yard. These 1 gallon samples shall be sealed by the Contractor for inspection by the City of New York's representative.

H. Recommended Laboratories for Analysis: Certified Laboratory for analysis and final submittals required.

a. Hummel & CO Inc. Address: 35
King St, Trumansburg, NY 14886
Phone: (607) 387-5694

b. Long Island Materials Testing Laboratory, Inc.
116-05 15th Ave.,
College Point, New York 11356
Phone: (718) 445-8300

c. 3rd Rock, LLC
580 Olean Road
East Aurora, NY 14052
Phone: (716) 655-4933

I. Standard of Soil Media Quality:

Standard of Quality shall be WeCare Extensive Type C as distributed by

a. WeCare Organics LLC
9293 Bonta Bridge Rd
Jordan, NY 13080
Phone 315-689-1996

b. Skyland USA
P.O. Box 159
Landenberg, PA 19350
Phone 610-268-0017

c. Organic Recycling, Inc.
117a Route 303
Tappen, New York
Phone 845-398-1012

d. Or approved equal.

2.12 PLANTINGS

A. Reference ASTM E 2400-06 for design standards.

B. The selection of the plants will be done with all varieties selected by the Green Roof Designer. The species will be in accordance with the known varieties that have been successfully incorporated into extensive roof design for the particular plant hardiness zone of the specified project. Plant selection that varies from the plant species recommended by the warrantor will not be warranted in any fashion.

1. Refer to landscape design drawings for plant varieties and spacing.

2. Establishment of the plants shall be in the same growing media mix designed specifically for this project.

C. Wind Erosion Blanket: As recommended for use with specified system by Landscape installers.

D. Plant Materials

NOTE: For quantities refer to the Contract Drawings.

CLUBHOUSE PLANTING

AC	Agrostis capillaris	Colonial Bentgrass	4" Pot	12" O.C.
ES	Eragrostis spectabilis	Purple Lovegrass	4" Pot	12" O.C.
SA	Sedum album	White Stonecrop	Plug	6" O.C.
SF	Sedum floriferum	Kamschatka Stonecrop	Plug	6" O.C.
SS	Sedum sexangulare	Tasteless Stonecrop	Plug	6" O.C.
SE	Sedum spurium 'Fuldaglut'	Two-Row Stonecrop	Plug	6" O.C.
SL	Symphyotrichum laeve	Smooth Blue Aster	4" Pot	12" O.C.

2.13 DRAIN ROCK FOR VEGETATION FREE ZONES

A. Aggregate Ballast: Washed, crushed stone or smooth stone that will withstand weather exposure without significant deterioration and will not contribute to membrane degradation, of the following size based on design requirements:

1. Size: ASTM D 448, Size 2, ranging in size from 3/4 to 1-1/2 inches.

2.14 EDGE RESTRAINT

A. Edge Restraint is a 90 degree slotted metal edge system complete with compatable splice plates to join sections together. The edge restraint surrounds the perimeter of the green roof system and acts as a slope break (see drawings).

2.15 IRRIGATION SYSTEM

A. See Detailed Specification 328000- Site Irrigation

PART 3 EXECUTION

3.1 INSPECTION

A. Examine substrates, areas, and conditions under which roofing and vegetative roof systems will be applied with Installer present, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after minimum concrete drying period recommended by roofing system manufacturer has passed.

2. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

3. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Verify positive slope on all roof areas. If necessary, install preformed saddles, crickets, tapered edge strips, and other insulation shapes as required for sloping to drain under the membrane.

B. Clean, prepare and prime substrate according to manufacturer written recommendations. Provide clean, dust-free, and dry substrate for roofing application.

C. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.

D. Protect roof drains and other deck penetrations to prevent spillage and migration of roofing fluids.

1. Where required, lower sumps to surface.

2. Disassemble and remove domes and clamping collars. Clean and examine sumps and drain components. Notify the City of New York's Representative of these components that are unsound.

3. Replace all bolts, broken or missing drain components and plastic strainers with metal components.

4. Any metal drain flanges shall be mechanically cleaned to bright metal. After cleaning, the metal shall be wiped with 200 Cleaner and primed with Metal Primer. A 60 wet mil (1.6mm) coating of TREM-LAR LRM vertical shall be installed to the primed metal surface. This preparatory coating shall extend a minimum three (3) inches (7.6 cm) onto the structural slab.

E. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

F. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

G. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

H. Pipe Penetrations: Any and all exposed metal surfaces (pipes, sleeves, vents, etc.) shall be cleaned. Remove paint, rust oil, seals or other foreign matter. After mechanical cleaning to bright metal, metal is to be wiped with Cleaner 200 and primed with Metal

Primer. A one (1) inch face cant is to be applied to the cleaned area. Sealant shall be allowed to cure for 24 hours.

I. Prime surface of concrete deck with asphalt primer at a rate of 3/4 gal/100 sq. ft. and allow primer to dry.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install cold process 2-ply membrane system with a cold process fully adhered TPA cap membrane according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-Up Roofing."

1. Install roofing system according to applicable specification plates of NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Allow the roof membrane to cure for 60 days before the installation of any vegetated roof components. OR, Utilize solvent free, cold process asphalt if the vegetated roof will be installed immediately after the waterproofing membrane.

C. The presence and activity of the manufacturer's representative, Commissioner's representative, and/or City of New York's representative shall in no way relieve Contractor of contract responsibilities or duties.

D. Start installation of roofing membrane system only in presence of roofing system manufacturer's technical personnel.

E. Any damages resulting from failure of the contractor to maintain the work area in a watertight condition, including areas under construction, areas of storage, and areas used for access, shall be the full responsibility of the contractor, and all repair costs required to repair such damage shall be borne by the Contractor.

F. Extreme care shall be taken to protect the new roofing and insulation. Watertight "tie-in" shall be installed upon completion of each day's work. The "tie-in" shall be completely water tight so as to protect the insulation and roofing. Completely remove the "tie-in" before beginning the next day's work.

G. Material, debris, equipment, and other requirements for completion of this project shall be scattered over the roof deck to avoid damage to the structural deck. Contractor assumes full responsibility for loading on the structural deck of roofing materials during all roofing operations. Commissioner/Engineer reserves the right to reject any loadings deemed unacceptable.

H. Contractor shall use reasonable care in transporting materials across the finished roof surface. Contractor shall minimize the use of any portion of the completed roof surface. Extreme care shall be taken to prevent damage to any roofing surfaces. Contractor shall protect all existing roof surfaces exposed to any more than casual foot traffic with no less than 1 layer of 1" thick polystyrene insulation directly on the roof surface and 1 layer of minimum 15/32 plywood. Contractor shall make permanent repairs to damaged areas of the existing roofing and flashing where workers have damaged the existing roofing or flashings.

I. Contractor shall maintain the job site in a safe, clean, and orderly fashion at all times. All doors and exits shall be made safe and secure from any possibility of falling debris or danger from any work associated with this project. PROPER AND ADEQUATE ACCESS AND EGRESS TO AND FROM THE BUILDING SHALL BE MAINTAINED AT ALL TIMES.

J. Upon completion of the roofing work the contractor shall thoroughly clean the area of all trash, debris, dust, dirt, etc. resulting from the contractor's work. In addition, all HVAC units shall be shut off and thoroughly washed with tap water.

K. The Contractor shall furnish all required storage enclosures, safeguards, and comply with all safety standards. Storage areas where hazardous or potentially hazardous products or equipment (including kettles) is stored shall be restricted to general access.

L. Rooftop hoisting equipment shall be properly assembled and maintained. Only persons that are thoroughly familiar with hoisting equipment shall operate such equipment. All such equipment shall be erected and supported so that it will not damage the existing structural deck or new roofing.

M. Debris shall be removed in a safe and orderly manner by appropriate means, and all roof debris becomes the property of the roofing contractor. Contractor shall be responsible for the lawful removal and disposal of all trash and debris.

N. Contractor shall employ only orderly and competent workers, skillful in the performance of the type work required.

O. Contractor shall erect all required roof barriers and safety lines as required by OSHA and comply with OSHA regulations for safety.

P. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work included in the Construction Documents. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to:

1. Employees on the Work and other persons who may be affected thereby;

2. The Work and materials and equipment to be incorporated therein; and

3. Other property at the site or adjacent thereto.

Q. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property at the site caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible.

R. Contractor shall comply with the most current (Occupational Safety and Health Administration) OSHA requirements as to the proper implementation of safety equipment as deemed necessary by such requirements for all employees of the

Contractor working on the Site, Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible. In addition, the Contractor shall provide at all times a minimum of three (3) complete additional safety equipment units, i.e. harnesses, rigging gear, hardhats, etc., as deemed necessary by the OSHA requirements for all workers. The three- (3) additional units are for the use by the City of New York, City of New Yorks' Representatives, Commissioner, Engineer, and A/E Inspectors.

S. No roofing work shall be performed below 40 degrees, or when the wind chill factor is below 40 degrees, or when rain is eminent (30% chance or greater). No roofing shall be performed when the average wind is above 25 mph without written permission from the Commissioner/Engineer. No roofing work shall be performed after 30 minutes prior to sundown. The roof deck shall be dry and free from any moisture, ice, or other deleterious materials prior to roofing.

T. All materials susceptible to moisture shall be protected in dry, above ground, watertight storage. ALL ROLL GOODS, INSULATION, CANT STRIP, AND TAPERED EDGE SHALL BE STORED IN WATERTIGHT, ENCLOSED TRAILERS, and these materials shall be loaded onto the roof on a daily basis for that day's work. All labels shall be intact and legible, clearly showing the product, manufacturer, and other pertinent information.

U. Any materials becoming wet or damaged will be rejected and shall be removed from the job site immediately. Any insulation found to be improperly stored at the job site should be considered wet at the discretion of the Commissioner/Engineer and removed from the job site.

V. Traffic and equipment shall be kept off completed plies until adhesive has set.

W. Wrapper and packaging materials shall not to be included in roofing system.

X. Entrapped aggregate shall not be permitted within new membrane.

Y. Install and secure preformed 45-degree wood cant at roof step down expansion joints.

Z. Ply shall never touch ply, even at roof edges, laps, tapered edge strips, and cants.

AA. Fit plies into roof drain rims; install lead flashing and finishing plies; secure clamping collars; install domes.

BB. Extend roofing membrane to top edge of cant at wall and projection bases.

CC. Cooperate with inspecting and testing agencies engaged or required to perform services for installing roofing membrane system.

3.4 INSULATION INSTALLATION

A. Design and install insulation system to guarantee positive drainage with a minimum roof slope of ¼":12".

1. Insulation shall be installed in strict accordance with the recommendations and requirements of the primary roof material manufacturer, NRCA, FM, UL Class A construction and these contract documents – the most restrictive governing.

B. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

C. Comply with roofing system manufacturer's written instructions for installing roof insulation.

D. Cant Strips: Install and secure 45-degree wood cant strips at junctures of built-up roofing membrane system with vertical surfaces or angle changes greater than 45 degrees.

E. Install insulation under area of roofing to conform to slopes indicated.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within 3/4 inch of projections and penetrations.

1. Where overall insulation thickness is 2 inches or more, install required thickness in 2 or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of 6 inches in each direction.

H. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

I. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

J. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Set each layer of insulation in a cold fluid-applied insulation adhesive.

K. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck. Tape joints if required by roofing system manufacturer.

1. Apply cold, fluid-applied adhesive to underside and immediately bond cover board to substrate.

3.5 ROOFING MEMBRANE INSTALLATION

A. All roof materials shall be as described in this specification and shall be provided by or approved by the primary warranting manufacturer.

B. Coordinate installing roofing system components so insulation and roofing membrane sheets are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

4. At all expansion joints, install the Waterproof Expansion Joint as shown on contract drawings.

C. Cold Process Asphalt Heating

1. An in-line heat exchange unit may be used to facilitate application

a. Do not exceed maximum adhesive temperature of 100° F.

2. Heat exchange unit: Use heat transfer oil approved by heating equipment manufacturer.

3. Follow operation procedures recommended by heating equipment manufacturer.

D. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.6 ROOFING AND FLASHING MEMBRANE APPLICATION

A. Apply rubberized asphaltic membrane according to manufacturer's written instructions.

B. Install 2 ply sheets starting at low point of roofing system. Align ply sheets without stretching. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane. Shingle in direction to shed water. Extend ply sheets over and terminate beyond cants.

1. Embed each ply sheet in a solid layer of cold roofing asphalt applied at rate required by roofing system manufacturer, to form a uniform membrane without ply sheets touching.

C. Avoid walking on plies until adhesive has set.

3.7 FULLY ADHERED CAP MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow it to relax before installing.

1. Install sheet according to ASTM D 5036.

B. Install cap sheet in cold water based bonding adhesive. Apply adhesive to substrate at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.

C. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.

D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.

2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.8 FLASHING MEMBRANE INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 VERIFICATION OF MEMBRANE INTEGRITY

A. General: After installing roof horizontal membrane and before placing overburden, verify installed membrane is waterproof. Provide testing to verify membrane is free of any holes, open seams and capillary defects that will allow water to penetrate the building envelope.

1. Utilize electrical conduction method EFVM (Electric Field Vector Mapping) as designed by International Leak Detection as follows:

a. Installation of EFVM impulse conductor wire around perimeter of area to be tested. The testing agency will determine the size and shape of the areas. Areas will typically range between 2000sf and 7500sf. The conductor wire will consist of braided polyethylene (1.5 mm in diameter) interwoven with a minimum of 9 strands of stainless steel wire. The conductor wire will have a tensile strength of not less than 180 lbs.
b. Place conductor wire 4 inches from the perimeter and secure against accidental movement or damage. Place so not to create a tripping hazard. Place wire directly on membrane.
c. Isolate all metal items contacting the membrane by placing isolation strands of conductor wire to isolate the field or by temporarily removing the metal items if possible.
d. Isolate field of membrane from contact with grounded soil or structure contacting the membrane by placing isolation strands of conductor wire.
e. Wet the test area with potable water sufficiently to create a continuous conducting "plate" above the membrane.
f. Attach EFVM impulse generator to conductor wire with removable connectors and to ground or building structure creating a potential circuit. (The circuit will complete if water finds a path to ground by way of a breach in the membrane.)
g. Deliver a 1 second long, 40 volt potential electrical pulse to the conductor wire at an average rate of one pulse every three seconds.
h. Utilizing a EFVM potentiometer and two probes placed at the surface of the membrane, detect the presence or absence of electrical flow across the surface to the membrane.
i. If there is no flow detected after a systematic search, then the certified inspector shall report the installed membrane in that area tested free of holes, seam and capillary defects and is therefore waterproof at that time.
j. If there is flow detected during the search, then the certified inspector shall work to identify the source of electricity and therefore the breach in the membrane. The technician shall report to the roofing contractor immediately if possible the exact location of any defects on the installed membrane in that area tested.
k. Defects found shall be repaired and retested.
l. The technician providing the EFVM test shall provide a report of each day's test results containing a written description and photograph of all defects and any corrections made and a schematic CAD drawing indicating location of stationary conductor wire and of any defects found in testing to within 1 inch

of accuracy. This report shall be made in hard copy and submitted to the Commissioner and City of New York.

3.10 FILTER FABRIC

A. Install filter fabric with the abrasion resistant (white) side facing up and the soft polyester fleece (gray) side down, overlapping edges and ends at least 2 inches. Do not lap ends of fabric sheets within 72 inches of roof perimeter. Extend fabric 2 to 3 inches above ballast at perimeter and penetrations. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation. Do not cover drains or restrict water flow to drains.

3.11 DRAINAGE MAT (SHEET DRAINAGE COMPOSITE)

A. Starting at one end of roof, unroll drainage board composite out with the, retention cups up to hold water for landscaping or if under hardscape the retention cups should open down to prevent the retention of water. Snap cups together at all side and end laps.

B. Adhesive or double sided tape can be used if needed to hold material down until installation of Growing Media. Spot glue a 2" x 2" square spaced every 4 to 6 feet.

C. It is essential to mark the position of roof outlets before installing drainage mat, so they can be located easily and cut for easy access.

D. Continue to roll to the end and cut to terminate.

E. Additional roll may begin at this point and continue the length of the roof. Fold the fabric back over the joint and tape fabric with tape and/or adhesives as required.

F. Install 2nd run of drainage mat identical to the 1st run, placing drain core parallel to the 1st run. Drain core should butt up to each other, side by side. Peel back enough salvage edge of top filter fabric, tucking one edge under the other and overlapping the seams.

G. Cover all exposed edges with extra filter fabric to ensure filter continuity. Use tape to tape the seams.

H. To prevent Growing Media from getting under this seam during installation, tape edges every 3 to 4 feet with tape.

I. Additional filter fabric should be extended up the side of all metal edge restraint and terminated flush with Growing Media.

J. Growing Media must be installed within 14 days after drainage mat installation in order to insure protection of the drainage mat.

K. Access Box Installation: As drainage board is being installed and roof drains have been located, cut a 12" x 12" opening in the drainage board for the Access Box. Place Access Box directly over the roof drain. Backfill Growing Media on the sides of the Access Box.

3.12 IRRIGATION INSTALLATION

A. See Detailed Specification 328000- Site Irrigation

B. Install the complete irrigation system at the recommended depth and spacing required by the manufacturer design. The depth and spacing may vary based on the requirements of the plantings.

C. Set the system to properly cycle and irrigate all areas as designed by the manufacturer.

3.13 GROWING MEDIA INSTALLATION

A. Media Mix Placement

1. Place Green Roof Media with approved equipment and protect all other materials form damage during installation.

   a. Installation shall be achieved by way of pneumatic blower truck to minimize excess compaction of the growing medium.
   b. The pneumatic blower truck shall be equipped with a PLC calibrated injection system.
   c. The unit shall be capable of uniformly applying materials and injected products at a rate greater than 0.15 cubic meters of material per minute up to a vertical limit of 150 feet. The blower truck shall also be equipped with an application hose capable of extending 300 feet from the blower truck unit. Contractor must have a minimum three (3) years proven experience in the application of using a Blower Truck.
   d. If a blower truck is not available, the material may be loaded in super sacks and lifted to the roof. The contractor must determine appropriate loading strategies through consultation with the structural engineer. On-grade applications may be transported in bulk via appropriate means and methods by the contractor. Do not store material on the ground and uncovered, so as to prevent contamination of the soil mix.

2. Pre-settlement: Preset the media by thoroughly watering the entire planting area.

3. Fill settled low areas with the media and repeat the compaction and filling process until settlement ceases.

B. Protection of Soil Mixes

1. Contamination and Compaction

2. Do not deliver or place soils in frozen, wet, or muddy conditions. Material should be at or near optimum compaction moisture content as determined by AASHTO T 99 (ASTM D 698). Do not place materials in an excessively moist condition.

3. When stockpiled, protect soils media from absorbing excess water and from erosion at all times. Do not store materials unprotected from large rainfall events. Do not allow excess water to enter site prior to compaction. If water is introduced

into the material after stockpiling, allow material to drain or aerate to optimum compaction moisture content.

4. In handling materials, operating tools and equipment, protect the media from compaction by laying down planking or plywood as required for protection.

5. Pressure wash equipment prior to handling media to prevent weed seed contamination.

3.14 PLANT INSTALLATION

A. Before installation of the vegetation, verify the finished grade of the growing medium.

B. Supply vegetation in strict accordance with warrantor requirements or with the instructions, plans and good practice.

C. Plant specified vegetation where designated on the drawings. Use planting methods as specified on the details.

1. Actual planting shall be performed during those periods when weather and growing medium conditions are suitable and in accordance with locally accepted practice, as approved by the Commissioner.

2. Only as many plants as can be planted and watered on that same day shall be distributed in a planting area.

3. Plants in containers shall be removed from containers in such a manner that the ball of earth surrounding the roots is not broken. The plants shall be planted and watered immediately after removal from the containers. Containers shall not be opened or removed prior to placing the plants in the planting area.

4. Set plants plumb and hold rigidly in position until soil has been tamped firmly around root ball.

5. After the plant has been placed, additional backfill shall be added to the hole to cover approximately one-half of the height of the root ball. At this stage, water shall be added to the top of the partly filled hole to thoroughly saturate the root ball and adjacent soil. Finish filling the hole with soil and tamp firmly.

6. All plants which settle deeper than specified on the planting details shall be raised to the correct level.

D. Do not prune plants except to remove damaged or dead growth.

3.15 EDGE RESTRAINT INSTALLATION

A. Edge Restraint VR is installed direct to the completed roof membrane substrate to outline Green Roof areas. Do not mechanically attach Edge Restraint VR through a watertight roof membrane, to prevent moisture penetration and roof leaks during the service life of the roof.

1. Edge Restraint can be either adhered or loose laid onto the completed roof membrane. Installations of Edge Restraint can be designed to rely on the weight of either ballast, pavers, or vegetated roof growing media to hold it in place, however, a sealant or adhesive compatible with the roof membrane is recommended to hold this metal edging in place during the placement of the Green Roof system.

3.16 DRAIN ROCK INSTALLATION

A. Lay ballast according to manufacturer's written instructions.

1. Install strips/areas (minimum width of 18") of stone/paver ballast for walkways and maintenance paths at all roof perimeter, building walls and penetrations (including drains) to act as vegetation barriers for the flashings as well as barriers to wind and fire and where indicated on Drawings.

2. Install curbs as designated to separate the soil areas from stone/ paver strip areas.

B. Install inspection maintenance boxes and grills over drains to ensure access at top of soil level.

C. Install paver stands on filter fabric. Level paver on stands or pedestals as required. Pavers shall be in an even plane with no noticeable unevenness.

3.17 FIELD QUALITY CONTROL

A. Manufacturer's Technical Representative: Contractor will engage a qualified manufacturer's technical representative acceptable to City of New York for full-time on-site monitoring to perform roof tests and inspections and to prepare test reports.

B. Flood Testing shall be used only if Low Vector Mapping is not applicable. Flood test each roof deck area for leaks, according to recommendations in ASTM D 5957, after completing roofing and flashing, but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.

2. Flood each area for 48 hours.

3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installation is watertight.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion of roofing membrane and flashing.

1. Notify Commissioner and City of New York 48 hours in advance of date and time of inspection.

D. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reapply roofing, and repair flashing.

1. After flood tests, repair leaks and make further repairs until roofing installation is watertight.

E. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

3.18 PROTECTING AND CLEANING

A. Protect roofing according to manufacturer written recommendations to prevent damage and wear during application and remainder of construction period.

B. Protect installed insulation from damage due to UV-light exposure, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the sheet metal work, as indicated on the drawings and/or specified herein, including but not limited to, the following:

1. Stainless steel cap metal flashing.

2. Stainless steel through wall flashing.

3. Field fabricating (including bending, cutting, soldering, etc.), if required, of stainless steel flashing.

4. Stainless steel flashing elsewhere, where metal flashing is indicated on drawings.

5. Separation of contacting surfaces of dissimilar metals.

1.3 RELATED SECTIONS

A. Unit masonry - Section 042000.

B. Exterior stone cladding - Section 044200.

C. Roofing - Division 7.

1.4 SUBMITTALS

A. Shop Drawings: Submit, showing all materials, finishes, fastenings, joint details, fabrication, construction and relation to adjoining construction.

B. Samples: Submit 12" x 12" samples of flashing materials and finishes.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim materials shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Sheet metal flashing and trim materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.6 WARRANTY

A. The Contractor shall warrant that all Metal Flashing Work executed under this Section will be free from defects in materials and workmanship for a period of two (2) years

from date of acceptance of the Project, and he shall remedy any defects in the Metal Flashing Work.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the City of New York.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Metal Flashing and Trim Schedule

1. MF-02: Steel Coping – Coated to match PE-01 as specified in Section 099000, Painting and Finishing.

B. Stainless Steel Flashing Materials

1. Stainless Steel Flashing: ASTM A 167, Type 304, stainless steel, with 2D finish, dead soft temper, fully annealed, as manufactured by International Nickel Co., Republic Steel Corp., United States Steel, or Washington Steel Corp. Thickness of stainless steel shall be 26 ga.

2. Through wall flashing shall have sawtooth ribs at three (3) inch interval as manufactured by Keystone Flashing Co., or approved equal.

3. Accessories and Fastenings: AISI, Types 302 and 304 stainless steel.

4. Solder: Composed of sixty (60) percent block tin and forty (40) percent pig lead, except that solder at seams exposed to public view shall be eighty (80) percent tin and twenty (20) percent lead.

5. Flux: An acid type flux manufactured specifically for soldering stainless steel, as approved.

C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where sheet metal work is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not

proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 METAL FLASHING INSTALLATION

A. Reference Standard: Conform to the requirements of 5th Edition of the Sheet Metal and Air Conditioning Contractors Association (SMACNA) Architectural Sheet Metal Manual.

B. General: Fabricate and install metal flashing work in accordance with details and specifications of above Reference Standard, with manufacturer's instructions, and as herein specified, to provide a watertight installation. Apply metal flashing to smooth, even, sound, clean, dry surfaces free from defects. Make provisions to allow for expansion and contraction of metal flashing work. Wherever practicable, shop form all metal flashing work and deliver ready for installation. Form metal flashing work accurately to required profiles, with flat surfaces, straight edges and corners, free from defects. Fold exposed metal edges back not less than 1/2" and form drip.

C. Nailing: Confine to sheets twelve (12) inches or less in width. Confine nailing to one edge only, locate nails where concealed. Use No. 12 x 1" long flat headed, annular threaded, Type 302 stainless steel nails for nailing to wood blocking; use one (1) inch long masonry nails for nailing to concrete. Space nails four (4) inches o.c. maximum.

D. Cleating: Use cleats where sheets are more than twelve (12) inches in width. Space cleats approximately twelve (12) inches o.c. Cleats two (2) inches wide by three (3) inches long, of the same material and weight as the metal flashing being installed. Secure one end of the cleat with two (2) nails and fold edge back over the nail heads. Lock other end into seam or into folded edge of metal flashing sheets. Pre-tin cleats for soldered seams.

E. Joining: Join metal flashings with one (1) inch locked and soldered seams except at slip joints. Mallet seams flat and solder full length of seam as specified below.

F. Soldering: Mechanically clean all metal surfaces to be soldered with steel wool. Clean and pre-tin edges of metal flashing to be soldered before soldering is begun with solder on both sides for a width of not less than 1-1/2". Solder slowly with well heated metal surfaces. Use ample solder. Show not less than one full inch of evenly flowed solder on seam. Seams shall have a liberal amount of flux brushed in before soldering is commenced. Where soldering paste or killed acid is employed as a flux, soldering shall follow immediately after application of the flux. Upon completion of soldering, clean surfaces of all flux.

G. Slip Joints: Locate slip joints not more than twenty four (24) feet apart and within 2' of corners and changes in direction. Form slip joints as three (3) inch wide joints with cover piece behind flashing, and fill locked ends neatly with sealant.

H. Cap Flashing: Install over base flashings, in eight (8) to ten (10) foot lengths, lapped six (6) inches at ends. Cap flashing shall be increased longitudinally to produce spring action to hold bottom edge of cap flashing firmly against base flashing. Cap flashing shall lap base flashing at least four (4) inches, with exposed bottom edge at a forty five

(45) degree angle downward and folded back on underside at least 1/2" to form drip. Make cap flashing continuous at corners and angles.

I. Miscellaneous Flashing: Provide all other miscellaneous metal flashing not specifically mentioned herein, but indicated on drawings and/or required to provide a watertight installation.

J. Separation of Dissimilar Materials: Back paint surfaces of metal flashing in contact with dissimilar metals or with concrete or masonry with bituminous paint.

K. Reglets

1. Provide watertight reglets in masonry and concrete work to receive cap flashing. Form reglets of stainless steel using same thickness as stainless steel sheet metal specified.

2. In masonry work use open or closed slot reglets with slat at least one (1) inch deep and 3/16" wide. Provide hook dams or turn-ups for anchoring securely into mortar joints. Insert cap flashing into slot full depth using button punch or lead wedges to lock in place.

3. In concrete work, use open or closed slot reglets with slot sloped upward at forty five (45) degrees, at least one (1) inch deep and 3/16" wide. For fastening reglets to concrete forms use double-head stainless steel nails spaced twelve (12) inches apart maximum.

4. Insert cap flashing full depth into reglet slot, and wedge in place using lead strips spaced on twelve (12) inch centers maximum or lead caulking rope. When lead strips are used for continuous caulked reglets, use approved weather-resistant fibrous compounds.

L. Through-the-Wall Flashings: Provide through-the-wall flashings as shown. Form bonding features so as not to puddle water on surface. Lap cross joints to interlock design pattern at least three (3) inches. Stop typical flashings in mortar joint 1/2" from exterior face of wall.

M. Scupper: Continuously support scupper, set to correct elevation, and seam frames to interior wall face, over cants or tapered edge strips, and under roofing membrane.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 077100

ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the roof specialties and accessories as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Stainless Steel copings.

1.3 RELATED SECTIONS

A. 073360 Vegetated Roof

1.4 SUBMITTALS

A. Before any roof specialties and accessories are delivered to the job site, submit shop drawings showing profiles and anchoring devices.

B. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy

attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Manufactured roof specialties materials shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Manufactured roof specialties materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 STAINLESS STEEL COPINGS

A. Fabricate of 316 brushed satin finish #4 Stainless Steel - 22 Gauge Thickness

B. Provide concealed splice plates 12 feet on center, fabricated of 316 stainless steel to match exposed stainless steel; finished to match exposed stainless steel

C. Provide pre-fabricated mitered and welded corner units.

D. For copings, provide galvanized steel anchor plates, anchors spaced 6'-0" o.c. and snap-lock coping design; all anchors concealed.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where roof specialties and accessories are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. General: Comply with manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, and with roof insulation, roofing and flashing; as required to ensure that each element of the work performs properly, and that combined elements are waterproof and weathertight. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

B. Isolation: Where metal surfaces of units are to be installed in contact with non-compatible metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation.

C. Cap Flashing: Where cap flashing is required as component of accessory, install to provide adequate waterproof overlap with roofing or roof flashing (as counter flashing). Seal with thick bead of mastic sealant, except where overlap is indicated to be left open for ventilation.

3.3 CLEANING AND PROTECTION

A. Clean exposed metal and plastic surfaces in accordance with manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 078413

FIRESTOPS AND SMOKESEALS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the firestops and smokeseals as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

3. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.

4. Sealant joints in fire-resistance-rated construction.

5. Penetrations at each floor level in shafts and/or stairwells.

6. Construction joints, including those between top of fire rated walls and underside of floors above; and those between exterior curtain walls and the outer perimeter edge of floor assemblies.

1.3 RELATED SECTIONS

A. Cast-in-place concrete - Section 033000.

B. Unit masonry - Section 042000.

C. Joint sealers - Section 079200.

D. Drywall - Section 092900.

E. Piping penetrations - Division 22.

F. Duct penetrations – Division 23.

G. Cable and conduit penetrations - Division 26.

1.4 REFERENCES

A. ASTM E 814 "Standard Method of Fire Tests of Through-Penetration Firestops."

B. UL 1479, UBC 7-5 (Both are same as A. above).

C. ASTM E 119 "Standard Method of Fire Tests of Building Construction and Materials."

D. UL 263, UBC 7-1 (Both are same as C. above).

E. UL 2079 "Tests For Fire Resistance of Building Joint Systems."

F. ASTM E 1399 "Test For Dynamic Movement Conditions."

G. ASTM E 1966 (Same as E. above).

H. Published Through-Penetration Systems by recognized independent testing agencies.

1. UL Fire Resistance Directory, Volume II of current year.

2. Warnock Hersey Certification Listings, current year.

3. Omega Point Laboratories, current year.

1.5 SUBMITTALS

A. Submit manufacturer's product literature for each type of firestop material to be installed. Literature shall indicate product characteristics, typical uses, performance, limitation criteria, test data and indication that products comply with specified requirements.

B. Submit shop drawings detailing materials, installation methods, and relationships to adjoining construction for each firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspection agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, for proposed UL listed (or equal) firestop and smokeseal assembly required for the Project.

C. Material Safety Data Sheets: Submit MSDS for each firestop product.

D. Submit qualifications of firestop installer, including letter from firestop manufacturer of products proposed to be installed, wherein manufacturer approves or recognizes as trained/ or certifies installer for installation of that manufacturer's products.

E. Manufacturer's Letters: For installations or configurations not covered by a UL or Warnock Hersey design number, a recommendation shall be obtained from the manufacturer, in writing, for the specific application.

F. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 QUALITY ASSURANCE

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, and the passage of smoke and other gases.

B. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

C. Firestopping products shall be asbestos free and free of any PCBs.

D. Do not use any product containing solvents or that requires hazardous waste disposal.

E. Do not use firestop products which after curing, dissolve in water.

F. Do not use firestop products that contain ceramic fibers.

G. Firestopping Installer Qualifications: Firestop application shall be performed by a single firestopping contractor who specializes in the installation of firestop systems, whose personnel to be utilized have received specific training from the proposed respective firestop manufacturer, and firestop installer shall have a minimum of three years' experience (under present company name) installing firestop systems of the type herein specified.

H. Mock-Up: Prepare job site mock-ups of each typical Firestop System proposed for use in the project. Approved mock-ups will be left in place as part of the finished project and will constitute the quality standard for the remaining work.

I. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's name, product identification, lot numbers, UL or Warnock Hersey labels, and mixing and installation instructions, as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturer.

C. All firestop materials shall be installed prior to expiration of shelf life.

1.8 PROJECT CONDITIONS

A. Verify existing conditions and substrates before starting work

B. Do not use materials that contain solvents, show sign of damage or are beyond their shelf life.

C. During installation, provide masking and drop cloths as needed to prevent firestopping products from contaminating any adjacent surfaces.

D. Conform to ventilation requirements if required by manufacturer's installation instructions or Material Safety Data Sheet.

E. Weather Conditions: Do not proceed with installation of firestop products when temperatures are in excess or below the manufacturer's recommendations.

F. Schedule installation of firestop products after completion of penetrating item installation but prior to covering or concealing of openings.

G. Coordinate this work as required with work of other trades.

1.9 SEQUENCING AND SCHEDULING

A. Pre-Installation Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Sequence: Perform work of this and other sections in proper sequence to prevent damage to the firestop systems and to ensure that their installation will occur prior to enclosing or concealing work.

C. Install all firestop systems after voids and joints are prepared sufficiently to accept the applicable firestop system.

D. Do not cover firestop systems until they have been properly inspected and accepted by the authority having jurisdiction.

1.10 LEED PERFORMANCE REQUIREMENTS

A. Applied fire-resistive materials shall contain recycled content as follows: Cementitious and/or fibrous fireproofing shall contain a minimum of 15% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Metal lath and reinforcing fabric shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content values shall be in accordance with Division 01 LEED Requirements Section.

B. Applied fire-resistive materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following manufacturers:

1. Tremco
2. Bio-Fireshield
3. 3M
4. Specified Technologies Inc.
5. U.S. Gypsum Co.
6. Nelson
7. Hilti, Inc.
8. Grace Flame Safe

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:
    a. Semirefractory fiber (mineral wool) insulation.
    b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Joint fillers for joint sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

D. Smokeseals at top of partitions shall be flexible to allow for partition deflection.

2.3 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

B. Intumescent, Latex Sealant: Single-component, Intumescent, latex formulation.

C. Intumescent Putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

D. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum or polyethelene foil on one side.

E. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

F. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.

G. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

H. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, non-shrinking foam.

I. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and non-sag formulation for openings in vertical and other surfaces requiring a non-slumping/gunnable sealant, unless firestop system limits use to non-sag grade for both opening conditions.

2.4 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

1. Sealant Colors: Color of exposed joint sealants as selected by the Commissioner.

B. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand 33 percent movement in both extension and compression for a total of 66 percent movement.

C. Multi-Component, Non-Sag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated.

D. Single-Component, Non-Sag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

2.5 MINERAL FIBER/CERAMIC WOOL NON-COMBUSTIBLE INSULATION (FIRE SAFING)

A. Provide min. 4 pcf Thermafiber as manufactured by Thermafiber Co., min. 4 pcf FBX Safing Insulation as manufactured by Fibrex, or approved equal to suit conditions and to comply with fire resistance and firestop manufacturer's requirements.

B. Material shall be classified non-combustible per ASTM E 119.

2.6 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 CONDITIONS REQUIRING FIRESTOPPING

A. Building Exterior Perimeters

1. Where exterior facing construction is continuous past a structural floor, and a space (i.e. construction joint) would otherwise remain open between the inner face of the wall construction and the outer perimeter edge of the structural floor, provide firestopping to equal the fire resistance of the floor assembly.

   a. If mineral wool is part of firestop system, the mineral wool must be completely covered by appropriate thickness of UL or Warnock Hersey listed firestop sealant or spray.
   b. Refer to Article 3.6 herein for description of fire safing insulation.

2. Firestopping shall be provided whether or not there are any clips, angles, plates, or other members bridging or interconnecting the facing and floor systems, and whether or not such items are continuous.

3. Where an exterior wall passes a perimeter structural member, such as a girder, beam, or spandrel, and the finish on the interior wall face does not continue up to close with the underside of the structural floor above, thus interrupting the fire-resistive integrity of the wall system, and a space would otherwise remain open between the interior face of the wall and the structural member, provide firestopping to continuously fill such open space.

B. Interior Walls and Partitions

1. Construction joints between top of fire rated walls and underside of floors above, shall be firestopped.

2. Firestop system installed shall have been tested by either UL or Omega Point, including exposure to hose stream test and including for use with steel fluted deck floor assemblies.

3. Firestop system used shall allow for deflection of floor above.

C. Penetrations

1. Penetrations include conduit, cable, wire, pipe, duct, or other elements which pass through one or both outer surfaces of a fire rated floor, wall, or partition.

2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814.

3. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, firestop annular space, if any, between sleeve and wall of opening.

D. Provide firestopping to fill miscellaneous voids and openings in fire rated construction in a manner essentially the same as specified herein before.

3.4 INSTALLING THROUGH PENETRATION FIRESTOPS

A. General: Comply with the through penetrations firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 INSTALLING FIRE RESISTIVE JOINT SEALANTS

A. General: Comply with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to

joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool no sag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.6 INSTALLING FIRESAFING INSULATION

A. Install fire safing insulation utilizing welded or screw applied galvanized steel impaling pins and retaining clips; space clips or pins 24" o.c. maximum.

B. Completely fill voids in areas where safing insulation is required. At spandrel conditions/floor edges, depth of insulation top to bottom shall be at least four (4) inches.

C. Cover top of all safing insulation with firestop sealant or spray.

3.7 FIELD QUALITY CONTROL

A. Special Inspection agency employed and paid by the City of New York will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Special Inspection agency will report observations promptly and in writing to Contractor, City of New York and Commissioner.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, Contractor must repair or replace firestopping so that it complies with requirements.

3.8 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to product firestopping complying with specified requirements.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 079200

JOINT SEALERS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the joint sealers work as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Flashing reglets and retainers.

2. Coping joints.

3. Exterior wall joints not specified to be sealed in other Sections of work.

4. Interior wall joints not specified to be sealed in other Sections of work, including caulking to fill between architectural woodwork and any wall, floor and/or ceiling imperfections.

5. Control and expansion joints in walls.

6. Joints at wall penetrations.

7. Joints between items of equipment and other construction.

8. All other joints required to be sealed to provide a positive barrier against penetration of air and moisture.

1.3 RELATED SECTIONS

A. Sealant at paving - Section 321313.

B. Exterior stone cladding - Section 044200.

C. Roofing – Division 7.

D. Firestop sealants – Section 078413.

E. Aluminum Framed Entrances and Structural Glass Curtain Walls - Section 084113.

F. Glazing sealants - Section 088000.

G. Sealant within drywall construction - Section 092900.

H. Sealant at tile work - Section 093000.

1.4 QUALITY ASSURANCE

A. Qualification of Installers: Use only personnel who are thoroughly familiar, skilled and specially trained in the techniques of sealant work, and who are completely familiar with the published recommendations of the sealant manufacturer.

B. Pre-Construction Field Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to project joint substrates according to the method in ASTM C 794 and C 1521 that is appropriate for the types of Project joints.

C. Perform testing per ASTM C 1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work shall start until results of these tests have been submitted to the Commissioner and he has given his written approval to proceed with the work.

1.5 SUBMITTALS

A. Shop Drawings: Submit shop drawings showing all joint conditions, indicating relation of adjacent materials, all sealant materials (sealant, bond breakers, backing, primers, etc.), and method of installation.

1. Submit joint sizing calculations certifying that movement capability of sealant is not being exceeded.

B. Samples: Submit the following:

1. Color samples of sealants, submit physical samples (not color chart).

2. Sealant bond breaker and joint backing.

C. Product Data: Submit manufacturer's technical information and installation instructions for:

1. Sealant materials, indicating that material meets standards specified herein.

2. Backing rods.

D. Submit manufacturer's certification as required by Article 1.7 herein.

E. Submit results of testing required in Article 1.4 herein.

F. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Caulking and sealants shall contain recycled content as follows: Cementitious fireproofing and/or fibrous fireproofing shall contain a minimum of 15% (combined) pre-consumer/post-consumer (the percentage of recycled content is based on the weight of the component materials). Metal lath and reinforcing fabric shall contain a minimum of 35% (combined) pre-consumer/post-consumer (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Caulking and sealants materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.7 MANUFACTURER'S RESPONSIBILITY AND CERTIFICATION

A. Contractor shall require sealant manufacturer to review the Project joint conditions and details for this Section of the work. Contractor shall submit to the Commissioner written certification from the sealant manufacturer that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vaportight seals (as applicable), and that materials supplied meet specified performance requirements.

1.8 ENVIRONMENTAL CONDITIONS

A. Temperature: Install all work of this Section when air temperature is above forty (40) degrees F. and below eighty (80) degrees F., unless manufacturer submits written instructions permitting sealant use outside of this temperature range.

B. Moisture: Do not apply work of this Section on surfaces which are wet, damp, or have frost.

1.9 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section, before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Storage

1. Store sealant materials and equipment under conditions recommended by their manufacturer.

2. Do not use materials stored for a period of time exceeding the maximum recommended shelf life of the material.

3. Material shall be stored in unopened containers with manufacturers' name, batch number and date when shelf life expires.

1.10 GUARANTEE

A. Provide a written, notarized guarantee from the manufacturer stating that the applied sealants shall show no material failure for a period of ten (10) years.

B. Contractor to provide a written, notarized, guarantee stating that the applied sealants shall show no failure due to improper installation for a period of two (2) years.

C. Guarantee shall be in a form acceptable to the City of New York and executed by an authorized individual.

D. Include in guarantee provision, agreement to repair and/or replace, at Contractor's expense, sealant defects which develop during guarantee period, because of faulty labor and/or materials.

PART 2 PRODUCTS

2.1 SEALANT MATERIALS

A. Exterior Wall Sealant: Provide one (1) part non-sag sealant equal to No. 790 or 795 made by Dow Corning, "Silpruf SCS 2000" or "LM SCS 2700" made by G.E. or "Spectrem 1" or "Spectrem 3" made by Tremco or "Sonolastic 150" by Sonneborn conforming to the minimum standards of ASTM C 920, Type S, Grade NS, Class 50.

B. Interior Sealant: Provide a one (1) part acrylic based sealant conforming to ASTM C 834, equal to "AC-20+ Silicone" made by Pecora or equal made by Tremco.

C. Colors: Custom colors of sealants as selected by the Commissioner.

2.2 MISCELLANEOUS MATERIALS

A. Back-Up Materials: Provide back-up materials and preformed joint fillers, non-staining, non-absorbent, compatible with sealant and primer, and of a resilient nature, equal to "HBR" made by Nomaco Inc. or approved equal, twenty-five (25) percent wider than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used. Provide back-up materials only as recommended by sealant manufacturer in writing.

B. Provide bond breakers, where required, of polyethylene tape as recommended by manufacturer of sealant.

C. Provide primers recommended by the sealant manufacturer for each material to receive sealant. Note that each exterior joint must be primed prior to sealing.

D. Provide solvent, cleaning agents and other accessory materials as recommended by the sealant manufacturer.

E. Materials shall be delivered to the job in sealed containers with manufacturer's original labels attached. Materials shall be used per manufacturer's printed instructions.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where joint sealers are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with instructions and recommendations of the manufacturer and in accordance with ASTM C 1193 for use of joint sealants as applicable to materials, applications and conditions required by this Project where more stringent installation requirements are specified herein, such requirements shall apply.

B. Sample Section of Sealant

1. During sealant installation work in exterior wall, the manufacturer of sealant shall send his representative to the site, under whose supervision a section of the wall (used as "control section") shall be completed for purposes of determining performance characteristics of sealant in joints. Commissioner shall be informed of time and place of such installation of control section.

2. Control section shall be installed according to specification given herein and shall not be considered as acceptable until written acceptance is provided by the Commissioner.

3. Accepted control section shall be standard to which all other sealant work must conform.

C. Supervision: The Contractor shall submit to the Commissioner written certification from the sealant manufacturer that the applicators have been instructed in the proper application of their materials. The Contractor shall use only skilled and experienced workmen for installation of sealant.

D. Apply sealant under pressure with a hand or power actuated gun or other appropriate means. Gun shall have nozzle of proper size and provide sufficient pressure to completely fill joints as detailed. Neatly point or tool joint to provide the contour as indicated on the drawings.

E. Preparation and Application

1. Thoroughly clean all joints, removing all foreign matter such as dust, oil, grease, water, surface dirt and frost. Sealant must be applied to the base surface. Previously applied film must be entirely removed.

2. Stone, masonry and concrete surfaces to receive sealant shall be cleaned where necessary by grinding, water blast cleaning, mechanical abrading, or combination of these methods as required to provide a clean, sound base surface for sealant adhesion.

a. Do not use any acid or other material which might stain surfaces.
b. Remove laitance by grinding or mechanical abrading.
c. Remove loose particles present or resulting from grinding, abrading, or blast cleaning by blowing out joints with compressed air, oil and water free, or vacuuming joints prior to application of primer or sealant.

3. Clean non-porous surfaces such as metal and glass chemically. Remove protective coatings on metallic surfaces by solvent that leaves no residue and is compatible

with sealant. Use solvent and wipe dry with clean, dry lint free paper towels. Do not allow solvent to air dry without wiping. Clean joint areas protected with masking tape or strippable films as above after removal of tape film.

4. Do not seal joints until they are in compliance with drawings, or meet with the control section standard.

5. Joint Size and Sealant Size: Joints to receive sealant shall be at least 1/4" wide. In joint 1/4" to 3/8" wide, sealant shall be 1/4" deep. In joints wider than 3/8" and up to 1" wide, sealant depth shall be one half the joint width. For joints wider than 1", sealant depth shall be as recommended by the sealant manufacturer. Depth of joint is defined as distance from outside face of joint to closest point of the filler.

6. Primer: Thoroughly clean joints and apply primer to all surfaces that will receive sealant. Apply primer on clean, dry surfaces, and prior to installation of joint backing. Completely wet both inner faces of the joint with primer. Mask adjacent surfaces of joint with non-staining masking tape prior to priming. Apply primer with clean brush and only when temperature is above 45 deg. F.

7. Joint Backing: In joints where depth of joint exceeds required depth of sealant, install joint backing (after primer is dry) in joints to provide backing and proper joint shape for sealant. Proper shape for sealant is a very slight "hourglass" shape, with back and front face having slight concave curvature. Use special blunt T-shaped tool or roller to install joint backing to the proper and uniform depth required for the sealant. Joint backing shall be installed with approximately twenty-five (25) percent compressions. Do not stretch, twist, braid, puncture, or tear joint backing. Butt joint backing at intersections.

8. Bond Breaker: Install bond breaker smoothly over joint backing so that sealant adheres only to the sides of the joint and not backing.

9. Sealant Application: Apply sealant in accordance with the manufacturer's application manual and manufacturer's instructions, using hand guns or pressure equipment, on clean, dry, properly prepared substrates, completely filling joints to eliminate air pockets and voids. Mask adjacent surfaces of joint with non-staining masking tape. Force sealant into joint in front of the tip of the "caulking gun" (not pulled after it) and force sealant against sides to make uniform contact with sides of joint and to prevent entrapped air or pulling of sealant off of sides. Fill sealant space solid with sealant.

10. Tooling: Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 4A in ASTM C 1193. Finished joints shall be straight, uniform, smooth and neatly finished. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Neatly remove any excess sealant from adjacent surfaces of joint, leaving the work in a neat, clean condition.

11. Replace sealant which is damaged during construction process.

END OF SECTION

SECTION 079500

EXPANSION CONTROL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the expansion joint covers as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. MF-04: Expansion Joint Cover

B. Fire rated expansion joint cover assemblies where required.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Masonry work - Section 042000.

C. Roofing - Section 073360.

D. Painting - Section 099000.

1.4 SUBMITTALS

A. Submit product data for each type of expansion joint cover assembly specified, including manufacturer's product specifications, installation instructions, details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Submit shop drawings showing fabrication and installation of expansion joint cover assemblies, including plans, elevations, sections, details of components, joints, splices, and attachments to other units of work.

C. Submit samples for verification purposes in full size units of each type of expansion joint cover assembly indicated; within sets for each finish, color, texture, and pattern specified, showing full range of variations expected in these characteristics. Install elastomeric material for joints, samples to verify color selected.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Miscellaneous metals required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.6 QUALITY ASSURANCE

A. Fire Test Response Characteristics: Where indicated, provide expansion joint cover assemblies identical to those assemblies whose fire resistance has been determined per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or ASTM E 119, including hose stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: 1 hour rating as shown on drawings.

B. Joint covers shall permit unrestrained movement of joint without disengagement of cover.

C. Floor joint cover plate assemblies shall be capable of supporting a 200 psf uniform load and a 300 lb. concentrated load with a deflection not to exceed 1/16".

1.7 DELIVERY, STORAGE AND HANDLING

A. Provide temporary protective cover on finished surfaces.

B. Deliver joint covers to jobsite in new, clean, unopened crates of sufficient size and strength to protect materials during transit.

C. Store components in original containers in a clean, dry location.

D. Handle components with equipment of sufficient size to preclude hazard to personnel or components.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Profiles and details shown on drawings are those of Construction Specialties unless otherwise noted; subject to compliance with requirements specified, other acceptable manufacturers include Balco/Metalines, Watson Bowman Acme, or MM Systems.

2.2 MATERIALS

A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6, sheet and plate; aluminum to have the following finishes:

1. Interior and exterior walking surfaces shall have clear anodized (A41) finish.

2. Exterior surfaces not subject to pedestrian traffic shall have a "Kynar 500" finish conforming to NAAMM 605.2; two (2) colors shall be required, one (1) color to match metal siding and the other color to match adjacent concrete surfaces.

3. Interior surfaces not subject to pedestrian traffic shall be shop primed with rust inhibitive primer, minimum 2 mils thick, ready to receive field painted finish.

B. Stainless Steel: ASTM A 666, Type 304, No. 4 finish.

C. Protect metal surfaces to be placed in contact with cementitious materials with a protective coating.

D. Extruded Preformed Seals: Single or multi-cellular elastomeric profiles as classified under ASTM D 2000, designed with or without continuous, longitudinal, internal baffles. Formed to fit compatible frames, in color, as selected by Commissioner from manufacturer's standard colors.

E. Fire Barriers: Designed for indicated or required dynamic structural movement without material degradation or fatigue when tested according to ASTM E-1399. Tested in maximum joint width condition with a field splice as a component of an expansion joint cover per ANSI/UL 263, NFPA 251, U.B.C. 43-1, or ASTM E 119, including hose stream test of vertical wall assemblies by a nationally recognized testing and inspecting agency acceptable to authorities having jurisdiction.

F. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.3 EXPANSION JOINT COVER ASSEMBLIES

A. MF-04: Expansion Joint Cover

B. General: Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated on drawings. Provide units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Furnish units in longest practical lengths to minimize number of end joints. Provide hairline mitered corners where joint changes direction or abuts other materials. Include closure materials and transition pieces, tee-joints, corners, transition pieces, curbs, cross-connections, and other accessories as required to provide continuous joint cover assemblies.

1. Special conditions shall be shop fabricated.

2. Fabricate components in largest practical lengths to minimize field splicing.

C. Moisture Barrier: Provide manufacturer's continuous, standard, flexible vinyl moisture barrier under covers at locations indicated.

D. Fire Rated Joint Covers: Provide expansion joint cover assemblies with manufacturer's continuous, standard, flexible fire barrier seals under covers at locations indicated to provide fire-resistive rating not less than the rating of adjacent construction.

PART 3 EXECUTION

3.1 PREPARATION

A. Manufacturer's Instructions: In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for phases of Work, including preparing substrate, applying materials, and protecting installed units.

B. Coordinate and furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure expansion joint cover assemblies to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

3.2 INSTALLATION

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting into new and existing construction as required to install expansion joint covers. Install joint cover assemblies in true alignment and proper relationship to expansion joints and adjoining finished surfaces measured from established lines and levels. Allow adequate free movement of thermal expansion and contraction of metal to avoid buckling. Set floor covers at elevations to be flush. Locate wall, ceiling, roof, and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories. Locate anchors at interval recommended by manufacturer, but not less than 3" from each end and not more than 24" o.c.

B. Continuity: Maintain continuity of expansion joint cover assemblies with a minimum number of end joints and align metal members mechanically using splice joints. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials (if any) to frames with adhesive or pressure sensitive tape as recommended by manufacturer.

C. Extruded Preformed Seals: Install seals complying with manufacturer's instructions and with minimum number of end joints. For straight sections provide preformed seals in continual lengths. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seal. Seal transitions according to manufacturer's instructions.

D. Elastomeric Sealant Joint Assemblies: Seal end joints within continuous runs and joints at transitions according to manufacturer's directions to provide a watertight installation.

E. Fire Barriers: Install fire barriers, including transitions and end joints, according to manufacturer's instructions so that fire-rated construction is continuous.

3.3 CLEANING AND PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

END OF SECTION

SECTION 081113

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the steel doors and frames work as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Galvanized hollow metal doors and frames for fire rated and unrated door openings.

2. Trimmed openings.

3. Hollow metal vision panels.

4. Preparation of metal doors and frames to receive finish hardware, including reinforcements, drilling and tapping necessary.

5. Preparation of hollow metal doors to receive glazing where required.

6. Steel louvers for hollow metal doors.

7. Furnishing anchors for building into masonry and drywall.

8. Factory prime painting of work of this Section.

1.3 RELATED SECTIONS

A. Unit Masonry - Section 042000.

B. Installation of doors and frames - Section 062000.

C. Wood Doors - Section 081416.

D. Finish hardware - Section 087100.

E. Glass and glazing - Section 088000.

F. Gypsum drywall - Section 092900.

G. Painting - Section 099000.

DDC Project ID# CRO-AGS
Croton Above Ground
Structure and Landscaping

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, compliance with standards referenced herein, sound and fire-resistance ratings, and finishes for each type of door and frame specified.

B. Shop Drawings: Show fabrication and installation of doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, reinforcement for surface applied hardware, dimensions of profiles and hardware preparation, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessories.

C. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Drawings.

1. Coordinate glazing frames and stops with glass and glazing requirements.

D. Oversize Construction Certification: For door assemblies required to be fire rated and exceeding limitations of labeled assemblies, submit certification of a testing agency acceptable to authorities having jurisdiction that each door and frame assembly has been constructed to comply with design, materials, and construction equivalent to requirements for labeled construction.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material

listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Steel doors and frames required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

C. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

D. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing custom steel doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain custom steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40" or less above the sill.

2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.

3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating as required by prevailing Building Code in 30 minutes of fire exposure.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

F. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

G. Fire rated assemblies must have M.E.A. approval with UL label.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.

B. Inspect doors and frames, on delivery, for damage. Minor damage may be repaired provided refinished items match new work and are approved by Commissioner; otherwise, remove and replace damaged items as directed.

C. Store doors and frames under cover at building site. Conform to the requirements of ANSI A 250-11-2001 for site storage unless more stringent requirements are noted herein. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 PRODUCTS

2.1 FABRICATION - GENERAL

A. Fabricate hollow metal units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable.

B. Unless otherwise indicated, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.

C. Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with Finish Hardware Schedule and templates provided by hardware suppliers. Comply with applicable requirements of ANSI A115 "Specifications for Door and Frame Preparation for Hardware."

D. Locate finish hardware as shown on final shop drawings in accordance with locations noted herein.

2.2 MANUFACTURERS

A. Provide products manufactured by Steelcraft, Curries, Ceco Door Products, or approved equal meeting these specifications.

2.3 FRAMES

A. Materials

1. Frames shall be made of commercial grade cold-rolled steel conforming to ASTM A 1008/A, Type B not less than 14 ga., and shall have a hot dipped galvannealed coating conforming to ASTM A 924 and A 653 with A-60 coating. The zinc-alloy coating shall be a dull matte surface treated for paint adhesion.

B. Design and Construction

1. All frames shall be welded units with integral trim, of the sizes and shapes shown on approved shop drawings. Unless otherwise noted, knocked-down frames will only be accepted in drywall assemblies that have the drywall panels in place prior to installing the door frame.

   a. Where knock-down frames are scheduled (at drywall), corners shall be mitered and reinforced with a wedge lock corner clip to provide a firm interlock of jambs to head.

2. All finished work shall be strong and rigid, neat in appearance, square, true and free of defects, warp or buckle. Molded members shall be clean cut, straight and of uniform profile throughout their lengths.

3. Jamb depths, trim, profile and backbends shall be as shown on drawings.

   a. Frames at drywall partitions shall be formed with double return backbends to prevent cutting into drywall surface.

4. Welded frames shall have corners mitered and reinforced and faces of welded frames shall be continuously back welded full depth and width of frame conforming to NAAMM Standard HMMA-820; face joints shall be hairline.

5. Minimum depth of stops shall be 5/8". Cut-off (Sanitary or hospital type) stops, where scheduled, shall be capped at forty-five (45) degrees at heights shown on drawings, and all jamb joints below cut-off stops shall be ground and filed smooth, making them imperceptible. Do not cut off stops on frames for soundproof, light proof or lead-lined doors.

6. Frames for multiple or special openings shall have mullion and/or rail members which are closed tubular shapes having no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth.

a. Mullions shall have 16 ga. internal steel stiffeners welded not less than 4" o.c.

7. Hardware Reinforcements

a. Frames shall be mortised, reinforced, drilled and tapped at the factory for fully-templated mortised hardware only, in accordance with approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates.

b. Minimum thickness of hardware reinforcing plates shall be as follows:
   1). Hinge and pivot reinforcements - seven (7) ga., 1-1/4" x 10" minimum size.
   2). Strike reinforcements - twelve (12) gauge
   3). Flush bolt reinforcements - twelve (12) gauge
   4). Closer reinforcements - twelve (12) gauge
   5). Reinforcements for surface mounted hardware - twelve (12) gauge.

8. Floor Anchors

a. Provide adjustable floor anchors, providing not less than two (2) inch height adjustment.
b. Minimum thickness of floor anchors shall be fourteen (14) gauge.

9. Jamb Anchors

a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the wire type. Anchors shall be not less than 0.156" diameter steel wire. The number of anchors provided on each jamb shall be as follows:
   1). Frames up to 7'-6" height - three (3) anchors.
   2). Frames 7'-6" to 8'-0" height - four (4) anchors.
   3). Frames over 8'-0" height - one (1) anchor for each 2'-0" or fraction thereof in height.
b. Frames for installation in stud partitions shall be provided with steel anchors of suitable design, not less than eighteen (18) gauge thickness, securely welded inside each jamb as follows:
   1). Frames up to 7'-6" height - four (4) anchors.
   2). Frames 7'-6" to 8'-0" height - five (5) anchors.
   3). Frames over 8'-0" height - five (5) anchors plus one additional for each 2'-0" or fraction thereof over 8'-0".
c. Knock-down frames for installation in stud partitions that have drywall panels in place prior to installation of door frames shall have compression anchors at each jamb placed 4" below head of frame and attached to steel stud, bottom of frame shall have 16 ga. adjustable steel clip anchors fastened to stud runner.

1). Where height of frame is 9'-0" or greater, provide two (2) compression anchors at each jamb spaced 4" apart starting 4" below head of frame.

d. Frames to be anchored to previously placed concrete or masonry shall be provided with minimum 3/8" concealed bolts set into expansion shields or inserts at six (6) inches from top and bottom and twenty-four (24) inches o.c. Reinforce frames at anchor locations with sixteen (16) gauge sheet steel stiffeners welded to frame at each anchor.

10. Anchors shall be hot dip galvanized per ASTM A 153.

11. Frames for installation in masonry wall openings more than 4'-0" in width shall have an angle or channel stiffener factory welded into the head. Such stiffeners shall be not less than twelve (12) gauge steel and not longer than the opening width, and shall not be used as lintels or load bearing members.

12. Dust cover boxes (or mortar guards) of not thinner than twenty-six (26) gauge steel shall be provided at all hardware mortises on frames to be set in masonry or plaster partitions.

13. Ceiling Struts: Minimum 3/8" thick x 2" wide steel.

14. All frames shall be provided with a steel spreader temporarily attached to the feet of both jambs to serve as a brace during shipping and handling.

15. Loose glazing stops shall be of cold rolled steel, not less than twenty (20) gauge thickness, butted at corner joints and secured to the frame with countersunk cadmium-or zinc-plated screws. Interior frames may be provided with snap-on glazing stops.

16. Except on weatherstripped frames, drill stops to receive three (3) silencers on strike jambs of single door frames and two (2) silencers on heads of double-door frames.

C. Finish: After fabrication, all tool marks and surface imperfections shall be removed, and exposed faces of all welded joints shall be dressed smooth. Frames shall then be chemically treated to insure maximum paint adhesion and shall be coated on all surfaces with one coat of rust-inhibitive baked-on alkyd primer standard with the manufacturer which is fully cured before shipment to a dry film thickness of 2.0 mils.

1. Frames set in masonry walls shall be grouted in as described in Section 042000 - Unit Masonry. These frames shall have surfaces in contact with grout shop coated with epoxy coating equal to Series 27 FC Typoxy made by Tnemec or approved equal spray applied at 4 to 6 mils, passing NFPA 101, Class A for smoke and flame spread, tested per ASTM E 84.

2.4 HOLLOW METAL DOORS

A. Materials: Doors shall be made of commercial quality, level, cold rolled steel conforming to ASTM A 1008/A, Commercial Steel, Type B and free of scale, pitting or

other surface defects. Face sheets shall be not less than sixteen (16) gauge and shall have a hot dipped galvannealed coating conforming to ASTM A 924 and A 653, A-60 coating. The zinc alloy coating shall be a dull matte surface treated for paint adhesion.

B. Design and Construction

1. All doors shall be of the types and sizes shown on the approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on their faces or vertical edges. Minimum door thickness shall be 1-3/4".

2. All doors shall be strong, rigid and neat in appearance, free from warpage or buckles. Corner bends shall be true and straight and of minimum radius for the gauge of metal used.

3. Face sheets shall be stiffened by continuous vertical formed steel sections spanning the full thickness of the interior space between door faces. These stiffeners shall be not less than twenty two (22) gauge spaced not more than six (6) inches apart and securely attached to face sheets by spot welds not more than five (5) inches o.c. Spaces between stiffeners shall be sound deadened and thermal insulated the full height of the door with an inorganic non-combustible batt type material.

4. Door faces shall be joined at their vertical edges by a continuous weld extending the full height of the door. All such welds shall be ground, filled and dressed smooth to make them invisible and provide a smooth flush surface.

5. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than fourteen (14) gauge, extending the full width of the door and spot welded to both faces. Doors shall have an additional flush closing channel at their top edges and, where required for attachment of weatherstripping, a flush closure also at their bottom edges. Openings shall be provided in the bottom closure of doors to permit the escape of entrapped moisture.

6. Edge profiles shall be provided on both vertical edges of doors as follows:

   a. Single-acting swing doors - beveled 1/8" in two (2) inches.
   b. Double acting swing doors - rounded on 2-1/8" radius.
   c. No square edge doors permitted.

7. Hardware Reinforcements

   a. Doors shall be mortised, reinforced, drilled and tapped at the factory for fully templated hardware only in accord with the approved hardware schedule and templates provided by the hardware supplier. Where surface-mounted hardware (or hardware, the interrelation of which is to be adjusted upon installation - such as top and bottom pivots, floor closers, etc.) is to be applied, doors shall have reinforcing plates.
   b. Minimum gauges for hardware reinforcing plates shall be as follows:
      1). Hinge and pivot reinforcement - seven (7) gauge.

2). Reinforcement for lock face, flush bolts, concealed holders, concealed or surface mounted closers - twelve (12) gauge.

3). Reinforcements for all other surface mounted hardware - sixteen (16) gauge.

8. Glass Moldings and Stops

a. Where specified or scheduled, doors shall be provided with hollow metal moldings to secure glazing by others in accordance with glass opening sizes shown on drawings.

b. Fixed moldings shall be securely welded to the door on the security side.

c. Loose stops shall be not less than twenty (20) gauge steel, with mitered corner joints, secured to the framed opening by cadmium or zinc-coated countersunk screws spaced eight (8) inches o.c. Snap-on attachments will not be permitted. Stops shall be flush with face of door.

9. Louvers shall be sixteen (16) gauge sheet steel, stationary type, closely spaced inverted "V" blade design, flush with face sheets of door, integral with and welded to door. Fifty (50) percent free area, unless indicated otherwise on drawings.

C. Finish: After fabrication, all tool marks and surface imperfections shall be dressed, filled and sanded as required to make all faces and vertical edges smooth, level and free of all irregularities. Doors shall then be chemically treated to insure maximum paint adhesion and shall be coated, on all exposed surfaces, with manufacturer's standard rust-inhibitive alkyd primer as specified for frames which shall be fully cured before shipment.

D. Flatness: Doors shall maintain a flatness tolerance of 1/16" maximum, in any direction, including in a diagonal direction.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for those openings requiring fire protection ratings as scheduled on drawings. Such doors and frames shall be labeled by Underwriters' Laboratories or other nationally recognized agency having a factory inspection service.

B. If any door or frame specified by the Commissioner to be fire-rated cannot qualify for appropriate labeling because of its design, size, hardware or any other reason, the Commissioner shall be so advised before fabricating work on that item is started.

2.6 HARDWARE LOCATIONS

A. The location of hardware on doors and frames shall be as noted in "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames" of the Door Hardware Institute unless otherwise required by prevailing Handicap Codes.

2.7 CLEARANCES

A. Fabricate doors and frames to meet edge clearances as follows:

1. Jambs and Head: 1/8" plus or minus 1/16".

2. Meeting Edges, Pairs of Doors: 1/8" Plus or minus 1/16".

3. Bottom: 3/4", if no threshold.

4. Bottom: 3/8", at threshold.

B. Fire rated doors shall have clearances as required by NFPA 80.

2.8 MANUFACTURING TOLERANCES

A. Manufacturing tolerance shall be maintained within the limits given in HMMA 841 of ANSI/NAAMM, current edition.

2.9 PREPARATION FOR FINISH HARDWARE

A. Prepare door and frames to receive hardware:

1. Hardware supplier shall furnish hollow metal manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to insure correct fitting and installation.

2. Preparation includes sinkages and cut-outs for mortise and concealed hardware.

B. Provide reinforcements for both concealed and surface applied hardware:

1. Drill and tap mortise reinforcements at factory, using templates.

2. Install reinforcements with concealed connections designed to develop full strength of reinforcements.

2.10 REJECTION

A. Hollow metal frames or doors which are defective, have hardware cutouts of improper size or location, or which prevent proper installation of doors, hardware or work of other trades, shall be removed and replaced with new at no cost.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where steel doors and frames are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Refer to Section 062000 for installation procedures for all work of this Section.

END OF SECTION

SECTION 081416

WOOD DOORS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the wood doors as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Solid core flush wood doors.

2. Fire rated flush wood doors.

1.3 RELATED SECTIONS

A. Installation of wood doors - Section 062000.

B. Hollow metal frames - Section 081113.

C. Finish hardware - Section 087100.

D. Glass and glazing - Section 088000.

E. Field painting - Section 099000.

1.4 SUBMITTALS

A. Product Data: Submit door manufacturer's product data, specifications and installation instructions for each type of wood door.

1. Include details of core and edge construction and trim for openings.

2. Include factory finish specifications.

3. Include certifications to show compliance with specifications.

4. Include certification to show compliance with AWI and WDMA requirements specified herein.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for finishing and other pertinent data.

1. Include requirements for veneer matching.

C. Submit samples of factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

    a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
    b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
    c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
    d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. For wood products, indication (Y/N) of whether the supplied product(s) are certified by the Forest Stewardship Council (FSC).

7. Documentation that all composite wood and agrifiber products do not contain added urea-formaldehyde.

8. Chain of custody certification to document FSC-certification, if applicable.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Engineered wood, not including salvaged wood, shall contain a minimum of 10% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

C. Finish carpentry materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Detailed Specification 01301, Article 1.06.

D. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated"; latest edition "Premium" grade and WDMA "Extra Heavy Duty" Performance Level.

1. Provide letter of licensing for Project indicating that doors comply with requirements of grade specified.

C. Fire Rated Wood Doors: Doors complying with Category A, Positive Pressure or Neutral Pressure testing standards per UBC 7-2-1997 and UL 10-C (UBC 7-2-1994 and UL 10B) that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Door Schedule, based on testing according to NFPA 252.

1. Conform to prevailing Code requirements to determine which pressure standard (Positive or Neutral) is required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature

and relative humidity at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) in excess of permitted standard noted in Article 2.4 herein, or show telegraphing of core construction in face veneers.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the life of the installation, starting from date of Substantial Completion.

PART 2 PRODUCTS

2.1 SOLID CORE FLUSH WOOD DOORS

A. Provide AWI PC-5 Premium Grade hot pressed 5-ply solid core particleboard doors, 1-3/4" thick, conforming to standards specified herein. Subject to meeting standards specified herein, the following manufacturers are acceptable: Marshfield Door Systems, Inc., Algoma Hardwoods Inc., or Eggers Hardwood Products Corp.

1. Core shall consist of a formed flat panel consisting of wood particles bonded together with synthetic resins or other added binder, with an average density of 30 to 32 lbs. per cubic foot. The material shall meet or exceed the requirements of ANSI A208.1, Grade 1-LD-2 covering mat formed particleboard with face screw holding of 124 lbs., modulus of rupture of minimum 700 psi and modulus of elasticity of not less than 148,000 psi.

2. Core shall be capable of satisfying this WDMA TM-7 cycle slam test for 1 million slams for surface mounted hardware. Where the manufacturer's core does not meet this criteria, stiles and rails must measure a minimum of 5-1/2" and must be fabricated of hardwood.

a. Surface mounted hardware must be installed with minimum 1-1/4" screw penetrations using threaded to the head screws; coordinate with Section 087100.

B. Cross Bands: Shall be 1/16" thick hardwood extending full width of door and laid with grain at right angles to face veneers. Cross bands and faces shall be laminated to the core with Type I MF or PVA glue.

C. Stiles, Rails: Stile and rail shall be a minimum of 1-3/8" solid hardwood or structural composite lumber (after trimming) laminated to the core. Stiles and rails must be securely glued to the core with no voids allowed. Stiles and rails must be capable of screw holding of 550 lbs. per WDMA TM-10.

D. Vertical door edge must be capable of screw holding of 550 lbs. per WDMA TM-10; horizontal door edge must be capable of screw holding of 400 lbs. per WDMA TM-10.

E. Doors with transparent finish to have center balanced, slip matched, veneer per finish schedule. Veneer to conform to AWI, "AA" grade veneer with 3" wide leaf. Minimum veneer thickness shall be not less than 1/50" after sanding.

1. Veneers shall be continuous or end matched at transoms.

F. Doors shall have hinge loading capacity of 500 lbs. per WDMA TM-8.

G. Where glass lites are noted, factory cut openings. Trim openings with solid hardwood moldings of same type of wood as face veneer. Lite openings in 20 minute rated doors shall have manufacturer's 20 minute approved hardwood system.

H. Doors to be field painted shall have MDO or hardboard face.

2.2 FIRE RATED WOOD DOORS ("B" LABEL)

A. Provide mineral core 1-3/4" thick solid core wood doors conforming to standards specified herein, manufactured by one of the manufacturers noted above. Stile construction on both stiles shall conform to the following:

1. Stile edge screw withdrawals when tested in accordance with ASTM D 1037-78 shall exceed 650 lbs. This applies to both stiles.

2. Stile edge split resistance when tested in accordance with ASTM D 143-52 (78) Modified must exceed 950 lbs. This applies to both stiles.

B. Door to have face finish as specified above in Article 2.1.

1. Where the core is free of urea formaldehyde, provide a layer of veneer over the substrate prior to application of finish veneer to prevent telegraphing of patterns from the adhesive.

C. Blocking: For surface mounted hardware only, provide composite blocking designed to maintain fire resistance of door but with improved screw-holding capability of same thickness as core and with minimum dimensions as follows:

1. 5-inch top rail blocking.

2. 5-inch bottom rail blocking.

3. 1 – 5" x 18" lock block at cylinder or mortise locksets.

4. 2 – 5" x 18" lock blocks at exit devices.

D. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

2.3 SHOP FINISH

A. Transparent Finish: Finish in the shop with clear satin catalyzed polyurethane finish conforming to AWI System "Catalyzed Polyurethane Transparent."

B. Opaque Finish: For doors to be field painted, shop prime on all surfaces with one coat of alkyd wood primer applied to a dry film thickness of 1.5 mils.

2.4 FABRICATION

A. Prefit and premachine wood doors at the factory.

B. Comply with the tolerance requirements specified herein. Machine doors for hardware requiring cutting of doors. Comply with final hardware scheduled and door frame shop drawings, and with hardware templates and other essential information required to ensure proper fit of doors and hardware.

C. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in the factory.

D. Doors shall be factory sized to door opening so that trimming and fitting are not required in the field.

E. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances unless otherwise indicated.

1. Three degree bevel or bevel to suit frame sizes indicated, with 3/16" prefit in width, +0/-1/32" tolerances. Prefit top of door 1/8" + 1/16"/-0" and undercut as required by floor condition. Undercut shall not exceed 1/8" from bottom of door to top of finished floor; where threshold occurs undercut shall not exceed 1/8" from bottom of door to top of threshold.

2. Comply with requirements in NFPA 80 for fire-rated doors.

F. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3 unless otherwise noted. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Provide concealed intumescent seals at fire-rated pairs of doors meeting the requirements of U.L. 10 C.

G. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kinds of doors required.

2.5 SOURCE QUALITY CONTROL

A. Once installed, maximum allowable warp, bow, cut or twist in doors shall be 1/16" as measured by the 1/16 inch feeler gauge and a straight-edge extending from corner to corner of the door face at stiles, top and bottom rails and along both diagonals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Refer to Section 062000 for installation of wood doors.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 083113

ACCESS DOORS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the access doors as indicated on the drawings and/or specified herein, including, but not limited to, the following:

1. Frameless recessed panel access doors at drywall ceilings and walls.

2. Framed flush panel access doors at masonry and tile walls.

3. Provide access doors and frames for access from occupied spaces to the following, where indicated or required, and as directed by the trades of Divisions 22, 23 and 26.

a. All shutoff or balancing valves.
b. Fire dampers, as required.
c. Points of duct access.
d. Pull boxes.
e. Controls of mechanical and electrical items.
f. Masonry shafts for pipes and conduits, as required.
g. Pipe spaces, if required.
h. Inlets of fans.
i. Fusible link and splitter damper at filter bank.
j. Automatic damper and motor.
k. Equipment not otherwise accessible.

4. Floor access doors.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Drywall - Section 092900.

C. Ceramic tile - Section 093000.

D. Valves and connections - Division 22.

1.4 QUALITY ASSURANCE

A. For actual installation of the work of this Section, use only personnel who are thoroughly familiar with the manufacturer's recommended methods of installation and who are completely trained in the skills required.

B. Fire-Resistance Ratings: Wherever a fire-resistance classification is shown, or for construction where access doors are installed, provide required access door assembly with panel door, frame, hinge and latch from manufacturers listed in Underwriters' Laboratories, Inc. "Classified Building Materials Index" for the rating shown.

1. Provide UL label on each access panel.

2. Provide flush, key operated cylinder lock.

C. Size Variations: Obtain Commissioner's acceptance of manufacturer's standard size units which may vary slightly from sizes shown or scheduled.

1.5 SUBMITTALS

A. Before any materials of this Section are delivered to the job site, submit complete manufacturer's literature to the Commissioner. Submit plans and schedules showing size and location of each and every access door for Commissioner's acceptance prior to installation.

B. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material

listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Steel doors and frames required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

C. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

D. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MATERIALS AND FABRICATION

A. Provide access door assembly manufactured by Milcor Inc, or equal made by Nystrom Inc., Karp Associates, Inc. or approved equal. Assembly shall be an integral unit complete with all parts and ready for installation. Minimum size 12" x 12", unless otherwise shown on drawings.

B. Fabricate units of continuous welded steel construction. Grind welds smooth and flush with adjacent surfaces. Provide attachment devices and fasteners of the type required to secure access panels to the types of supports shown.

C. Contractor shall provide access doors of sizes that are in agreement with specific access requirements defined by equipment manufacturer.

D. Frames for Masonry and Tile Wall Only (Flush Panel Units): Fabricate frame from sixteen (16) gauge steel. Provide frame with exposed flange not less than one (1) inch wide around perimeter of frame for exposed masonry and tile finishes.

1. For installation in masonry construction, provide frames with adjustable metal masonry anchors.

E. Frameless Units for Drywall Surfaces (Recessed Panel Units): Provide access doors without exposed frames for drywall adhered to recessed panel.

F. Panels: Fabricate from fourteen (14) gauge steel, with concealed spring hinges set to open to 175 degrees. Provide removable pin type hinges of the quantity required to support the access panel sizes used in the work. Finish with manufacturer's factory applied baked enamel prime coat applied over phosphate protective coating on steel.

G. Locking Devices

1. For non-rated access doors, provide flush, screwdriver operated cam locks of number required to hold door in flush, smooth plane when closed.

2. For fire rated doors, provide locks as described in paragraph 1.4, B. herein.

H. Inserts and Anchorage: Furnish inserts and anchoring devices which must be built into masonry for the installation of access panels. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

I. Floor Access Doors: Type J, single leaf, horizontal access door by Bilco or approved equal.

1. Size: 30 inches by 30 inches

2. Cover: 1/4 inch steel diamond pattern, reinforced to support a minimum live load of 300 psf with a maximum deflection of $1/150^{th}$ of the span.

3. Frame: 1/4 inch steel channel frame with full anchor flange around the perimeter.

4. Hinges: Designed for horizontal application, through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and through bolted to the frame with Type 316 stainless steel bolts and locknuts.

5. Drain Coupling: 1-1/2 inch drain coupling in right front corner of channel frame unless otherwise indicated.

6. Lifting Mechanisms: Compression spring operators enclosed in telescopic tubes to provide smooth, easy, and controlled cover operation throughout entire arc of opening and to act as a check in retarding downward motion of the cover when closing.

7. Equip units with hardware for manual release operation from outside, locking mechanism, and security contact/indicator switch. Also provide panic bar from underneath, removable steel cover plate flush with ground, and fall protection integrated with hatch inside.

8. Provide a removable exterior lift/turn handle with a spring loaded ball detent to open the cover. Latch release shall be protected by a flush, gasketed, removable screw plug.

9. Hardware

    a. Hinges
    b. Hold open arm
    c. Compression spring operators
    d. Type 316 stainless steel snap lock with fixed handle mounted to underside of cover.

10. Finish: Factory finished red oxide primer. Field paint in accordance with Section 099000, Painting and Finishing.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where access doors are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install access doors in accordance with the manufacturer's recommendations and approved Shop Drawings.

3.3 COORDINATION

A. Coordinate all work with the mechanical trades to ensure proper locations and in a timely manner to permit orderly progress of the total work.

B. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.

C. Adjust hardware and panels after installation for proper operation.

D. Remove and replace panels or frames which are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 083316

COILING COUNTER DOORS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the coiling counter doors as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Coiling counter doors, fire-rated.

2. Motor operation.

3. Guides, anchors and hardware required for complete installation and operation.

1.3 RELATED SECTIONS

A. Overhead Coiling Doors - Section 083323.

B. Side-Sliding Grilles - Section 083336.

C. Electrical - Division 26.

1.4 QUALITY ASSURANCE

A. Fire Rated Assemblies: Furnish fire rated assemblies where scheduled on drawings which comply with NFPA No. 80 and have been fire tested, rated and labeled in accordance with ANSI/ASTM E152. Furnish each shutter with a metal UL label as evidence of rating, with label indicating rating in hours of duration of exposure to fire and letter designation of location for which assembly is designed.

B. Automatic Closing: Provide automatic closing device and governor, operating when activated by temperature rise and melting of 160 deg. F. (71 deg. C.) fusible link and smoke detector. Construct governor unit to be inoperative during normal shutter operations. Design release mechanism for easy resetting.

1. Fabricate unit to permit manual lifting of curtain for emergency use after automatic closing, with curtain returning to closed position when released.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling counter shutter. Include manufacturer's operating instructions and maintenance data.

B. Shop Drawings: Submit shop drawings indicating location and size of each unit, details for special components, surrounding conditions and installations which are not fully dimensioned or detailed in manufacturer's data.

C. Label Certification: Submit UL certification for fire rated shutters and frames.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Doors and frames required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide pre-assembled overhead coiling counter doors units manufactured by McKeon Door Company, Metro Door, Atlas, Overhead Door Corp., Cornell Iron Works Inc., or approved equal meeting these specifications.

B. Basis of Design Products

1. OD-02: Electrically-operated, overhead-coiling fire and smoke rated coiling counter doors shall be "Model CFS" as manufactured by McKeon Door Company, or approved equal. Slats shall be stainless steel, Type 304, No. 4 polished finish. For size, see Architectural Contract Drawings.

2.2 MATERIAL DESCRIPTION

A. Fabricate overhead coiling counter curtain of interlocking flat slats fabricated from 0.025" stainless steel. Each slat to be fitted with endlocks to hold curtain in alignment. Bottom of curtain to be finished with stainless steel angle and lift handle and a continuous neoprene bumper to prevent counter abrasion.

B. Furnish inserts and anchoring devices which must be secured to concrete or built into masonry or drywall assemblies for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

2.3 CURTAIN ACCESSORIES

A. Barrel and Counterbalance: Curtain to be coiled around a steel pipe fitted with involute shaped rings for ease of operation. Rings to be faced with suitable material to prevent curtain abrasion. Barrel to be of sufficient thickness and diameter to prevent deflection exceeding 0.03" per ft. Barrel to be supported by plate brackets. Helical, oil-tempered springs shall be installed inside the steel pipe, which shall rotate on self-lubricating bearings. Spring tension shall be adjusted in the field by means of an adjusting wheel.

B. Hood: Fabricated from 0.025" thick stainless steel sheet, Type 304, complying with ASTM A 666; hood shall be provided to enclose mechanism and end brackets. Barrel shall be mounted as part of the complete assembly within the hood. At fire rated units, furnish automatic drop baffle to guard against passage of smoke or flame.

C. Provide stainless steel frame consisting of jambs and sill finished to match curtain. Form grooves into sides of frames for retaining curtain.

2.4 MOTOR OPERATOR

A. Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.

1. Operator Controls

a. Key operation with open, close, and stop controls.
b. Controls for interior location.
c. Controls flush mounted.

B. Safety Edge Device: Provide each shutter with an electric safety switch, extending full width of shutter bottom, and located within a neoprene astragal mounted to the bottom rail. Contact with switch before fully closing will immediately stop the downward travel and reverse direction to the fully opened position.

C. Locking Device: Curtain shall have cylinder locking device, including cylinder and 2 deadbolts, one at each end. Provide electric interlocks that prevent motor from operating when lock is engaged.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where coiling counter doors are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do

not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install units complete with necessary hardware, in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

B. Upon completion of installation, including work by other trades, test, lubricate and adjust shutters to operate easily, free from warp, twist or distortion.

C. Install fire rated units to comply with NFPA 80.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 083323

OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the overhead coiling doors as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Overhead coiling doors, insulated, fire-rated.

2. Hardware and accessories.

3. Motor operation.

1.3 RELATED SECTIONS

A. Coiling Counter Doors - Section 083316.

B. Side-Sliding Grilles - Section 083336.

C. Finish Hardware - Section 087100.

D. Painting and Finishing - Section 099000.

E. Electrical - Division 26.

1.4 QUALITY ASSURANCE

A. Furnish each overhead coiling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

B. Provide each type of overhead coiling door by one manufacturer for entire project.

C. Wind Loading: Design and reinforce exterior overhead coiling doors to withstand a thirty (30) lb. per square foot wind loading pressure, unless otherwise indicated.

D. Fire-Rated Overhead Coiling Door Assemblies

1. Furnish overhead coiling door assemblies where scheduled on drawings which comply with NFPA No. 80 and have been fire tested, rated and labeled in accordance with ANSI/ASTM E 152. Furnish each shutter with a metal UL label as evidence of rating, with label indicating rating in hours of duration of exposure to fire and letter designation of location for which assembly is designed.

2. Provide automatic closing device and governor, operating when activated by temperature rise and melting of one hundred sixty (160) degrees F. (71 deg. C.) fusible link and smoke detector. Construct governor unit to be inoperative during normal shutter operations. Design release mechanism for easy resetting.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door. Include operating instructions and maintenance information.

B. Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets.

C. Label Certification: Submit UL certification for fire-rated doors and frames.

D. Samples: Submit color and finish samples for finish type required.

1. OD-01: Submit 12 inches x 12 inches sample

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Doors and frames required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide roll up doors manufactured by McKeon Door Company, Metro Door, Atlas, Overhead Door Corp., Cornell Iron Works Inc., or approved equal meeting these specifications.

B. Basis of Design Product

1. OD-01: Electrically-operated, overhead-coiling fire and smoke rated doors shall be Auto-Set Model FSFD-M-SD-G as manufactured by McKeon Door Company or approved equal. For size, see Architectural Contract Drawings. Paint finish – Color PE-01.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Shutter Curtain: Fabricate overhead coiling door curtains of interlocking flat slats designed to withstand required wind loading, of continuous length for width of doors, without splices. Provide slats of structural quality, minimum twenty (20) gauge cold-rolled galvanized steel sheets complying with ASTM A 924, Grade A, with G90 zinc coating, complying with ASTM A 653, and phosphate treated before fabrication.

1. Curtain shall be insulated with 1" urethane and 22 ga. back-up sheet.

B. Endlocks: Malleable iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Windlocks: Malleable iron castings secured to curtain slats with galvanized rivets. Provide windlocks on roll-up doors approximately twenty-four (24) inches o.c. on both edges of curtain.

D. Bottom Bar: Consisting of two (2) angles, each not less than 1-1/2" x 1-1/2" x 1/8" thick, either galvanized or stainless steel or aluminum extrusions to suit type of curtain slats.

E. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build up units with minimum 3/16" thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment.

1. Secure continuous wall angle to wall framing by 3/8" minimum bolts at not more than twenty-four (24) inches o.c. Extend wall angles above overhead coiling door opening head to support coil brackets, unless otherwise shown. Place anchor bolts on exterior wall guides so they are concealed when overhead coiling door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and continuous bar for holding windlocks.

F. Weather Seals: Provide vinyl or neoprene weatherstripping for exterior doors. At door heads, use 1/8" thick continuous sheet secured to inside of curtain coil hood. At door jambs, use 1/8" thick continuous strip secured to exterior side of jamb guide.

2.3 COUNTERBALANCING MECHANISM

A. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with required barrel rings. Use grease sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support curtain without distortion of slats and limit barrel deflection to not more than 0.03" per foot of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of cast-hardened steel, of required size to hold fixed springs ends and carry torsion load.

E. Brackets: Provide mounting brackets of manufacturer's standards design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

F. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head, and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.

1. Fabricate steel hoods for doors of not less than twenty (20) gauge hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 525. Phosphate treat before fabrication.

2. At fire rated assemblies furnish automatic drop baffle to guard against passage of smoke or flame.

2.4 INSERTS AND ANCHORAGES

A. Furnish inserts and anchoring devices which must be set in concrete or built into masonry for installation of units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

B. Refer to concrete and masonry Sections of these specifications for installation of inserts and anchorage devices.

2.5 PAINTING

A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with door manufacturer's standard rust inhibitive primer.

B. After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion.

C. Paint with high performance coating as specified in Section 099000, Painting and Finishing.

2.6 ELECTRIC DOOR OPERATORS

A. Furnish electric door operator assembly of size and capacity recommended and provided by door manufacturer; complete with electric motor and factory pre-wired motor controls, gear reduction unit, solenoid operated brake, remote control stations, control devices, conduit and wiring from controls to motor and control stations, and accessories required for proper operation.

B. Provide hand operated disconnect or a mechanism for automatically engaging a sprocket and chain operator and releasing brake for emergency manual operation. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

C. Design operator so that motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.

D. Door Operator Type: Provide wall or bracket mounted door operator units consisting of electric motor, worm gear drive from motor to reduction gear box, chain or worm gear drive from reduction box to gear wheel mounted on counterbalance shaft, and a disconnect-release for manual operation. Provide motor and drive assembly of horsepower and design as determined by door manufacturer for size of door required.

E. Electric Motors: Provide high starting torque, reversible, constant duty, Class A insulated electric motors with overload protection, sized to move overhead coiling door in either direction, from any position, at not less than 2/3 foot nor more than one (1) foot per second.

1. Coordinate wiring requirements and current characteristics of motors with building electrical system.

2. Furnish totally enclosed, non-ventilated type motors, fitted with plugged drain, and controller with NEMA Type 4 enclosure.

F. Remote Control Station: Provide momentary contact, 3-button control station with push button controls labeled "open," "close," and "stop."

1. Provide interior units, full-guarded, surface mounted, heavy duty, with NEMA Type 4 enclosure.

G. Automatic Reversing Control: Furnish each door with automatic safety switch, extending full width of door bottom, and located within neoprene or rubber astragal mounted to bottom door rail. Contact with switch before fully closing will immediately stop downward travel and reverse direction to fully opened position. Connect to control circuit through retracting safety cord and reel, or self-coiling cable.

1. Provide electrically actuated automatic bottom bar.

H. Locking Device: Curtain shall have cylinder locking device, including cylinder and 2 deadbolts, one at each end. Provide electric interlocks that prevent motor from operating when lock is engaged.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where overhead coiling doors are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install overhead coiling door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

1. Install fire-rated doors to comply with NFPA 80.

B. Upon completion of installation, including work by other trades, lubricate, test and adjust overhead coiling doors to operate easily, free from warp, twist or distortion and fitting weather-tight for entire perimeter.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 083336

SIDE-SLIDING GRILLES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Work of this Section includes all labor, materials, equipment, and services necessary to complete the side-sliding grilles as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Coiling Counter Doors - Section 083313.

B. Overhead Coiling Doors - Section 083323.

1.4 QUALITY ASSURANCE

A. Provide each side-sliding grille as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

B. For actual installation of the side-sliding grilles, use only personnel who are thoroughly trained and experienced in installation of the selected products and who are completely familiar with the requirements of this work.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, rough-in diagrams, and installation instructions for each type and size of side-sliding grille. Include operating instructions and maintenance data.

B. Shop Drawings: Submit shop drawings indicating location and size of unit, details for special components, surrounding conditions and installations which are not fully dimensioned or detailed in manufacturer's product data.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Steel doors and frames required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide side-sliding grilles manufactured by Metro Door, or equivalent product of Cornell Iron Works Inc., Atlas, or approved equal.

B. Basis of Design Product

1. OD-03: Provide "Econoguard Sliding Grille," overhead track mounted, as manufactured by Metro Door Company. For size, see Architectural Contract Drawings. Finish: Clear anodized aluminum.

2.2 MATERIAL DESCRIPTION

A. Curtain shall be constructed of aluminum horizontal links spaced 12" apart and 5/16" vertical rods 2-3/4" on center. Grilles shall be aluminum conforming to ASTM B 221, with mill finish.

1. Vertical posts shall be aluminum extrusions consisting of a leading edge, a trailing edge, and an intermediate post when curtain exceeds 10'-0".

2.3 ACCESSORIES

A. Cylinder locking hook lock in leading edge with wall mounted aluminum wall strike. Cylinder operated drop bolt in intermediate post with dust proof floor strikes.

B. Track shall be extruded aluminum 1-3/4" wide by 1-1/2" high with clear anodized finish.

2.4 MANUAL OPERATION

A. Manually operated with factory-installed pull handle on leading edge.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where side-sliding grilles are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do

not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install grilles and operating equipment complete with necessary hardware, in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

B. Upon completion of installation including work by other trades, test and adjust grilles to operate easily, free from warp, twist, or distortion.

END OF SECTION

SECTION 084113

ALUMINUM-FRAMED ENTRANCES AND STRUCTURAL GLASS CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. This Section describes the general requirements for a complete, custom aluminum curtain wall system clad with custom finished stainless steel sheet fastened to the aluminum curtain wall system with concealed connectors. The custom die formed, extruded aluminum curtain wall system shall be provided with fully thermally isolated indoor and outdoor components with 'rain screen' pressure equalization chambers, and shall be capable of structurally spanning vertically between support locations shown while maintaining sight lines established on the Contract Drawings. The complete system shall also include custom vertical stainless steel wood clad sunshade components with concealed connectors and all custom and standard flashings, connectors, accessories and miscellaneous components recommended by the curtain wall system manufacturer specified for a complete water- and weather tight permanent installation complying with all governing codes and the requirements of this Specification whether or not shown.
   a. The complete glazed aluminum curtain wall system shall also include all fasteners, trim, dry-seal joint gaskets, pressure plates, closure plates, custom stainless steel snap covers, anchors, inserts, support brackets, expansion devices, weeps, custom and factory-formed transition cladding and flashing, fascias, and all other custom components as necessary to complete the work.
   b. Contractor shall supply a job mock-up before proceeding with the Work and all labor, materials, equipment and incidentals as shown, specified and required to furnish, install and place into satisfactory service all components of the curtain wall system work.
2. Aluminum- framed Entrances with manually operated awning windows
3. Custom patch supported curtain wall system
4. Custom patch supported curtain wall system supported by glass fins
5. Exterior framed curtain wall / sun shade louver assembly.

B. Related Sections:

1. Section 088000- Glazing.

2. Section 064023 – Architectural Woodwork

1.3 REFERENCES

A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.

B. New York City Building Code

C. American Architectural Manufacturers Association (AAMA)
1. 101-05 Specification for Windows, Doors and Unit Skylights
2. 501.1: Standard Test Method for Metal Curtain Walls for Water Penetration Using
3. Dynamic Pressure.
4. 502-2: Voluntary Specification for Field Testing of Windows and Sliding Doors.
5. 501.2: Field Check of Metal Curtain Walls for Water Leakage.
6. 501.3: Field Check of Water Penetration Through Installed Exterior Windows, Curtain Walls and Doors by Uniform Air Pressure Difference.
7. 605.2: Specification for High Performance Organic Coatings on Architectural
8. Extrusions and Panels.
9. 503.1-98 Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
10. 2605-05 Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
11. CW-13 Structural Sealant Glazing Systems (a design guide)
12. TIR-A9 Metal Curtain Wall Fasteners

D. American National Standards Institute (ANSI): Z97.1 -Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
1. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1and testing requirements of CPSC 16 CFR Part 1201 for category II materials. Subject to compliance with requirements and local authorities having jurisdiction, provide safety glass with a removable certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction

E. American Society for Testing and Materials (ASTM)
1. A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service.
2. A307: Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
3. B209: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. B211: Specification for Aluminum-Alloy Bar, Rod, and Wire.
5. B221: Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
6. B316: Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods.

7. C67-03a: Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
8. C126-12: Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
9. C424-93(12): Standard Test Method for Crazing Resistance of Fired Glazed Whitewares by Autoclave Treatment.
10. C484 - 99(09): Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile
11. C719: Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cycle Movement.
12. C794: Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
13. C1036: Specification for Flat Glass.
14. C1048: Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
15. C1135-00 Test Method for Determining Tensile Adhesion Properties of Structural Sealants
16. C1148-00 Standard Specification for Structural Silicone Sealants
17. C1376-03 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
18. C1401-02 Standard Guide for Structural Sealant Glazing
19. D395: Test Methods for Rubber Property-Compression Set.
20. D412: Test Methods for Rubber Properties in Tension.
21. D1171: Test Method for Rubber Deterioration -Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens).
22. D2240: Test Method for Rubber Property -Durometer Hardness.
23. D2244 -09b Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
24. E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
25. E283: Test Method for Rate of Air Leakage Through Exterior Window, Curtain Walls, and Doors.
26. E330: Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
27. E331: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
28. E413: Classification for Sound Rating Insulation.
29. E773: Test Method for Seal Durability of Sealed Insulating Glass Units.
30. E774: Specifications for Sealed Insulating Glass Units.
31. E783: Method for Field Measurement of Air Leakage Through Installed Exterior
32. Windows and Doors.
33. E84: Standard Method of Test for Surface Burning Characteristic of Building Materials.
34. E1300 Specification for Determining Load Resistance of Glass in Buildings.
35. E2188:Standard Test Method for Insulating Glass Unit Performance
36. E 2190: Standard Specification for Insulating Glass Unit Performance and Evaluation

F. Consumer Product Safety Commission (CPSC): 16CFR 1202 -Architectural Glazing Standards and Related Material.

G. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.

H. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units".

I. Insulating Glass Certification Council (IGCC): Classification of Insulating Glass Units.

J. Energy Conservation Construction Code of New York State (ECCCNYS)- 2010.

K. National Fenestration Rating Council (NFRC).
   1. NFRC 100: Procedure for Determining Fenestration Product U-Factors.
   2. NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmission at Normal Incidence.

L. Builders Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156

M. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:

      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Glazing-to-glazing contact.
      e. Noise or vibration created by wind and by thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Sealant failure.
      h. Failure of operating units.

B. Engineering Criteria: Provide aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and engineering criteria indicated.

C. Structural Loads:
   1. Wind Loads: The Building Envelope/Cladding systems shall be designed, fabricated, and installed to withstand the maximum positive and negative wind pressures as required by the Building Code of the City of New York. Design loads for the following criteria:
      a. Basic Wind Speed: 98 mph.
      b. Building Classification: III

c. Importance Factor: 1.0
d. Exposure Category: D.

2. Seismic Loads: Seismic loading in accordance with NYC Building Code Chapter 16 and referenced sections of ASCE 7-05.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite (L/175 of clear span for spans up to 13 feet 6 inches and to L/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch, whichever is smaller; amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch and clearance between members and operable units directly below them to less than 1/16 inch.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. for projected window maximum air leakage limit should be 0.09 CFM/ft when subjected to 6.24 PSF of positive pressure.

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. Provide aluminum framed system with rain-screen pressure equalization chambers.

H. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

I. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    b. Low Exterior Ambient-Air Temperature: 0 deg F.

3. Interior Ambient-Air Temperature: 71 deg F.

J. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than **53** when tested according to AAMA 1503.

K. Thermal Conductance of Fixed Glazing & Framing: Provide structural glass and aluminum-framed thermally-broken systems with fixed glazing and framing areas having an average U-factor of not more than 0.5 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

L. Thermal Conductance of Operable Glazing & Framing: Provide aluminum-framed systems with operable glazing and framing areas having an average U-factor of not more than 0.55 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

M. Thermal Conductance of Entrance Door Glazing & Framing: Provide aluminum-framed systems with entrance door glazing and framing areas having an average U-factor of not more than 0.85 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

N. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
1. Outdoor-Indoor Transmission Class (OITC): Minimum 34 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

O. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

P. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.

C. Shop Drawings: Shop drawings and calculations for all work within this section to be signed and sealed by a professional engineer licensed to practice in the state of New York. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

H. Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and engineering criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of aluminum-framed systems.
2. Include design calculations.

I. Qualification Documentation: For qualified Manufacturer, Installer and testing agency.

J. Seismic Qualification Certificates: For aluminum-framed systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

K. Welding certificates.

L. Preconstruction Test Reports: For sealant.

M. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

N. Source quality-control reports.

O. Quality-Control Program for Structural-Sealant-Glazed System: Include reports.

P. Field quality-control reports.

Q. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

R. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

B. Manufacturer Qualifications: The manufacturer providing the material or equipment specified in this section must, for the past five (5) years, have been regularly engaged in the manufacture of material or equipment similar in type to that required for this Project. Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Engineering Documentation: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project. Submit all information to the Commissioner for review and approval prior to the start of work.

E. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.

F. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by the Commissioner, except with the Commissioner's approval. If revisions are proposed, submit comprehensive explanatory data to the Commissioner for review.

G. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.

1. Test a minimum five samples each of metal, glazing, and other material.
2. Prepare samples using techniques and primers required for installed systems.
3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

H. Accessible Entrances: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

I. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

J. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

K. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

L. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

M. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless the Commissioner specifically approves such deviations in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

N. Pre-installation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

1.9 CODE REQUIREMENTS

A. All work shall be performed in accordance with the New York City Building Code, or the requirements of this specification, whichever are more stringent.

1.10 WARRANTY SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and instructions as needed for City of New York's continued adjustment, service, and removal and replacement of entrance door hardware.
2. Initial Guarantee Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive service, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

B. Structural-Sealant-Glazed Systems:

1. Initial Guarantee Service: Beginning at Substantial Completion, provide six (6) months' full service by skilled employees of structural-sealant-glazed system Installer. Include quarterly preventive service, repair or replacement to ensure long-term performance and

durability of structural-sealant-glazed system as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide storefronts and entrances systems of one of the following manufactures that meet or exceed requirements of these specifications :
   1. Gartner / Permasteelisa Group
   2. Seele Inc - New York
   3. Rauschmann – New Haven CT.
   4. Stahlbau Pichler – Bolzano Italy
   5. Tri Pyramid
   6. Wausau Windows Systems, Inc.
   7. W & W Glass LLC - New York
   8. Approved Equal

2.2 MATERIALS

A. Aluminum:
   1. Alloy and Temper: Provide alloy and temper as indicated or as otherwise recommended by the aluminum producer or finisher.
   2. Aluminum Extrusion: Alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B221 for 6063-T5. Nominal wall thickness of .0125" or greater for structural wall extrusions.
   3. Sheet and Plate: Alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B209.
   4. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   5. Extruded Structural Pipe and Tubes: ASTM B 429.
   6. Structural Profiles: ASTM B 308/B 308M.
   7. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
   4. Galvanized; Hot Dipped: ASTM A526 for all exterior steel where applicable.

C. Stainless Steel

1. Stainless steel panels and cladding exposed shall be type 316.

2. Stainless Steel Shapes, Sheet and Fasteners:
   a. Bars and Strips: UNS S31803, ASTM A351

   b. Sheet (non-structural): UNS S31600, ASTM A480. (All stainless steel sheet to be stretcher level and stress-relieved). All exposed Stainless Steel sheet to be minimum 14 gauge (0.0791" or 1.984mm) thick. Exposed stainless steel sheet faces shall be of such flatness that the maximum uniform bow in feet shall not exceed 1/32 inch and the maximum overall variation in plane between high and low point within a panel shall not exceed 1/16 inch

   c. Bolts and Screws: ASTM F593; Alloy groups 1 and 2, non-magnetic

   d. Nuts: ASTM F594; Alloy groups 1 and 2, non-magnetic

3. Fittings: Patch Supported integral fitting shall be predominantly manufactured from stainless steel Grade 316L. The finish of all fittings will be "as machined" with exposed finishes receiving a glass bead blasted finish.
   a. The manufacturer/fabricator shall demonstrate to the Commissioner's satisfaction that the stresses induced in the glass by these fittings are compatible with the strength of the glass and the needs of the performance section of the specification.

   b. Fittings shall provide a tolerance capability which will cope with the full range of the movement specified.

D. Fasteners: Provide aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum components. Exposed fasteners shall match finish of members and hardware being fastened. All fasteners in "wet" areas to be stainless steel 304. Furnish of basic metal and alloy, matching finished color and texture as the metal being fastened, unless otherwise indicated. Unless otherwise shown, provide concealed or countersunk screws for exposed fasteners.

E. Concealed Flashing: Dead-soft stainless steel, 26 gage minimum, or extruded aluminum, 0.062 in. minimum, of an alloy and type selected by manufacturer for compatibility with other components.

F. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.

G. Concrete/Masonry Inserts: Cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.

H. Compression Weatherstripping: Manufacturer's standard replaceable stripping of molded neoprene or PVC gaskets complying with ASTM D 2287.

I. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

J. Glazing: As specified in Section 088000.

K. Glazing Accessories: As specified in Section 088000.

L. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded neoprene or PVC gaskets, of profile and hardness required to maintain watertight seal.

M. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

N. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

O. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.

a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 100g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Color: As selected by the Commissioner from manufacturer's full range of colors.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Color: As selected by the Commissioner from manufacturer's full range of colors

P. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

Q. Manually Operated Awning Windows: Manufacturer's standard glazed awning windows.

1. Hardware: Provide hardware units as indicated, scheduled, or required for operation of awning windows from ground level and as selected by the Commissioner.

R. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Entrance Door Hardware: Provide hardware units as indicated, scheduled, or required for operation of each door and as selected by the Commissioner.
2. Provide sliding-type weather stripping mortised into meeting edges of paired exterior doors.
3. Provide weather sweeps applied to exterior door bottoms.

2.3 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using manufacture standard fabrication systesm.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.4 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

OR

B. High-Performance Organic Finish: 3 -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by the Commissioner from manufacturer's full range.

2.5 STAINLESS STEEL FINISHES

A. General: Remove tool and die marks and stretch lines or blend into finish. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
1. Directional Satin Finish:

2.6 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate structural-sealant-glazed systems.

B. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations, including, but not limited to, system material-qualification procedures, sealant testing, and system fabrication reviews and checks.

C. Structural-sealant-glazed system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
b. Install weatherseal sealant according to Division 07 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.

a. Destructive Test Method A, "Hand Pull Tab (Destructive)," in ASTM C 1401, Appendix X2, shall be used.

1) A minimum of two areas on each building face shall be tested.
2) Repair installation areas damaged by testing.

2. Structural-Sealant Glazing Inspection: After installation of aluminum-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to recommendations in ASTM C 1401.
3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by the Commissioner shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SPECIFICATION 087100

FINISH HARDWARE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. All Finish Hardware unless otherwise specified elsewhere.

1.3 RELATED SPECIFICATIONS

A. DDC General Conditions

B. 081113 Steel Doors & Frames

C. 081416 Wood Doors

D. 084113 Aluminum Framed Entrances & Structural Glass Curtain Wall

1.4 SUBMITTALS

A. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Detailed Specification 01301 – LEED Certification Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Detailed Specification 01301 – LEED Certification Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Finish hardware shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Detailed Specification 013010.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Detailed Specification 01302, Part 2, where applicable.

PART 2 PRODUCTS

2.1 HEAVY-DUTY PIVOT SETS

A. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.

B. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches high and one additional intermediate pivot per leaf for each additional 30 inches in height or fraction there-of. Intermediate pivots spaced equally not less than 25 inches or not more than 35 inches on center, for doors over 121 inches high.

C. Provide appropriate model where pivot sets are specified at fire rated openings.

D. Provide lead-lined model where pivot sets are specified at lead-lined doors.

E. Provide electric pivot, located nearest to the electrified locking component, with sufficient number and gage of concealed wires to accommodate electric function of specified hardware. If the manufacturer of the electrified locking component requires another device for power transfer then provide the recommended power transfer device and the appropriate quantity of pivots.

F. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

G. Acceptable manufacturers and/or products: Ives, Dorma, Rixson.

H. Continuous Hinges:

1. Provide continuous hinges, where specified in the hardware sets, fabricated from 14 gauge, 304 stainless steel, with .25 inch diameter stainless steel hinge pin.

2. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.

3. Hinges shall be capable of supporting door weights up to 600 pounds, and shall be successfully tested for 1,500,000 cycles.

4. On fire-rated doors, provide continuous hinges that are classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.

5. Provide continuous hinges with electrified option where specified. Provide with sufficient number and gauge of concealed wires to accommodate electric function of specified hardware.

6. Install hinges with fasteners supplied by manufacturer. Hole pattern shall be symmetrically patterned.

7. Acceptable manufacturers and/or products: Markar, McKinney, Zero.

2.2 ELECTRIC POWER TRANSFER

A. Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.

B. Electric power transfer is to be located per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

C. Acceptable manufacturers and/or products: Von Duprin, Markar, Monarch.

2.3 ELECTRIFIED MORTISE LOCKS

A. Provide electrified mortise locks from the same manufacturer as mechanical mortise locksets certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case. Cylinders: Refer to 2.12 KEYING.

B. Provide locks with a standard 2-3/4 inches backset with a full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1 inch throw, constructed of stainless steel.

C. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

D. Provide electrical options as scheduled. Provide electrified locksets with micro switch (RX) option that monitors the retractor crank, and is actuated when rotation of the inside or outside lever rotates the retractor hub. Provide normally closed contacts or normally open contacts as required by security system.

E. Provide power supplies, recommended and approved by the manufacturer of the electrified lockset.

F. Lever trim shall be solid stainless steel, cast or forged in the design specified, with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle.

1. Lever design shall be Dorma Plus 8906, or approved equal.

2. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.

2.4 MORTISE LOCKS

A. Provide mechanical mortise locks from the same manufacturer as electrified mortise locksets certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case. Cylinders: Refer to 2.08 KEYING.

B. Provide locks with a standard 2-3/4 inches backset with a full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1 inch throw, constructed of stainless steel.

C. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

D. Lever trim shall be solid brass, bronze, or stainless steel, cast or forged in the design specified, with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle.

1. Lever design shall be Dorma Plus 8906, or approved equal.

2. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.

2.5 ELECTRIFIED VERTICAL ROD PANIC EXIT DEVICES

A. Provide electrified exit devices from the same manufacturer as mechanical exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware. Cylinders: Refer to 2.12 KEYING.

B. Exit devices shall be touchpad type, fabricated of brass, bronze, stainless steel, or

aluminum, plated to the standard architectural finishes to match the balance of the door hardware.

C. Touchpad shall extend a minimum of one half of the door width. Touch-pad finish shall be compatible to exit device finish. Compression springs will be used in devices, latches, and outside trims or controls, tension springs also acceptable.

D. Provide manufacturer's standard strikes.

E. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.

F. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.

G. Non-fire-rated exit devices shall have cylinder dogging.

H. Removable mullions shall be a 2 inches x 3 inches steel tube. Where scheduled, mullion shall be of a type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.

I. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

1. Lever style will match the lever style of the locksets.

2. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.

J. Exit devices for fire rated openings shall be UL labeled fire exit hardware.

K. Provide electrical options as scheduled.

L. Provide power supplies, recommended and approved by the manufacturer of the electrified exit device.

M. Acceptable manufacturers and/or products: Dorma 9000 series.

2.6 VERTICAL ROD PANIC EXIT DEVICES

A. Provide mechanical exit devices from the same manufacturer as electrified exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware. Cylinders: Refer to 2.08 KEYING.

B. Exit devices shall be touchpad type, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.

C. Touchpad shall extend a minimum of one half of the door width. Touch-pad finish shall be compatible to exit device finish. Compression springs will be used in devices, latches, and outside trims or controls, tension springs also acceptable.

D. Provide manufacturer's standard strikes.

E. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Engineer.

F. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.

G. Non-fire-rated exit devices shall have cylinder dogging.

H. Removable mullions shall be a 2 inches x 3 inches steel tube. Where scheduled, mullion shall be of a type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.

I. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

1. Lever style will match the lever style of the locksets.

2. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.

J. Exit devices for fire rated openings shall be UL labeled fire exit hardware.

K. Acceptable manufacturers and/or products: Dorma 9000 series.

2.7 CYLINDERS AND KEYING SYSTEM

A. All cylinders shall be kyed to the existing Dorma key system, conforming to the following requirements:

1. Provide high security restricted patented removable core cylinders at all keyed devices. High security cores shall incorporate a double-locking feature through the use of a side bar or second set of pins. Restricted shall control the access to the products by requiring a signed letter of authorization and/or authorization form from the City or authorized agent of the City. Patent shall protect against the unauthorized manufacturing and duplication of the products. High security restricted patented cores shall not be operable by non-patented key blanks and will not be allowed if they can be compromised by removing material from the manufacturers non-patented key blank. High security restricted patented cores shall incorporate a mechanism to check for the patented features on the keys. Provide construction cores with construction master keying for use during construction. The hardware supplier, accompanied by the City or City's security agent, shall install permanent keyed cores upon completion of the project. The temporary construction cores are to be returned to the hardware supplier.

2. Provide permanent cores keyed by the manufacturer or authorized distributor as directed by the City. Provide City with a copy of the bidding list, return receipt requested.

3. The hardware supplier, accompanied by a qualified factory representative for the manufacturer of the cores and cylinders, shall meet with City and Engineer to review keying requirements and lock functions prior to ordering finish hardware. Submit a keying schedule to Engineer for approval.

4. Provide cores, unless noted otherwise, operated by a Great Grand Master Key System to be established for this project. Allow for ten Grand Master Keys under the Great Grand. Do not use the letter "I", "O", or "X" for any of the grand masters. Allow for twenty-four Master Keys under each Grand Master, and sixty-four changes under each master key. All cylinders shall be keyed in alike or different sets as noted by their respective key set number. Do not use the letter "I" or "O" in any of the master key sets.

5. Provide high security restricted patented keys able to operate the manufacturer's patented restricted cylinders and high security restricted patented cylinders within the same master key system as follows:

a. Ten grand master keys for each set.

b. Ten master keys for each set.

c. Three keys per core and/or cylinder.

d. Two construction core control keys.

e. Two permanent core control keys.

f. Six construction master keys for each type (Contractor is to provide one set of construction keys to Architect).

6. Visual key control:

a. Keys shall be stamped with their respective key set number and stamped "DO NOT DUPLICATE".

b. Grand master and master keys shall be stamped with their respective key set letters.

c. Do not stamp any keys with the factory key change number.

d. Do not stamp any cores with key set on face (front) of Core. Stamp on back or side of cores so not to be visible when core is in cylinder.

7. Deliver grand master keys, master keys, change keys, and/or key blanks from the factory or authorized distributor directly to the City in sealed containers, return receipt requested. Failure to comply with these requirements may be cause to require replacement of all or any part of the keying system that was compromised at no additional cost to the City.

2.8 OVERHEAD SURFACE-MOUNTED DOOR CLOSERS

A. Provide surface door closers certified to ANSI/BHMA A156.4 Grade 1 requirements. Units shall be stamped with date of manufacture code.

B. Door closers at exterior doors and doors over 8'-0" high shall have fully hydraulic, full rack and pinion action with a high strength cylinder and metal cover, and shall utilize full complement bearings at shaft. Cylinder body shall be minimum 1-1/2 inch diameter, and double heat-treated pinion shall be 11/16 inch diameter.

C. Door closers at interior doors up to 8'-0" high shall have fully hydraulic, full rack and pinion action with a high strength cylinder and metal cover, and shall utilize full complement bearings at shaft. Cylinder body shall be minimum 1-1/8 inch

diameter, and double heat-treated pinion journals shall be 1/2 inch diameter.

D. Provide hydraulic fluid requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.

E. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force as required by accessibility codes and standards. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and backcheck.

F. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.

G. Closers shall not incorporate Pressure Relief Valve (PRV) technology.

H. Closer cylinders, arms, adapter plates, and metal covers shall have a powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or shall have special rust inhibitor (SRI).

I. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other finish hardware items interfering with closer mounting.

J. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Engineer.

K. Door closers for exterior doors and doors over 8'-0" high meeting this specification: Dorma 8900 series. (or equal)

L. Provide closer arms capable of 180 degree opening as indicated on Door Schedule.

2.9 FLUSH BOLTS AND AUTOMATIC FLUSH BOLTS

A. Provide automatic and manual flush bolts with forged bronze face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. Top rods at manual flush bolts for doors over 90 inches in height shall be increased by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

B. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.

2.10 COORDINATORS

A. Provide a bar-type coordinating device, surface applied to the underside of the stop at the frame head where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors.

B. Provide a filler bar of the correct length for the unit to span the entire width of the opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

C. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.

2.11 THRESHOLDS

A. Provide thresholds as specified and per architectural details. Match finish of other items as closely as possible. Size of thresholds shall be as follows:

1. Bumper Seal Thresholds – 1/2 inch high x 5 inches wide x door width

B. Acceptable manufacturers and/or products: National Guard, Reese, Zero.

PART 3 EXECUTION

3.1 INSTALLATION

A. Pre-installation Meeting: Prior to installation of hardware, conduct a meeting with the Hardware Supplier, Hardware Installers, and Representatives of locks, exit devices, closers, automatic operators and electrified hardware for the purpose of instructing installers on proper installation and adjustment of finish hardware. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Engineer.

B. Wire (including low voltage), conduit, junction boxes, and pulling of wire is by Division 16, Electrical. Electrical Contractor shall connect wire to door position switches and run wire to central room or area as directed by the Engineer. Wires shall be tested and labeled with the Engineer's opening number. Connections to/from power supplies to electrified hardware and any connection to fire/smoke alarm system, and/or smoke evacuation system where specified is by Division 16 Electrical.

3.2 SCHEDULES

A. It is intended that the following schedule includes complete items of finish hardware necessary to complete the work. If a discrepancy is found in the schedule, such as a missing item, improper hardware for a frame, door or fire codes, the preamble will be the deciding document.

B. Locksets, exit devices, and other hardware items are referenced in the Hardware Sets for series, type, and function. Refer to the preamble for special features, options, cylinders/keying, and other requirements.

C. Manufacturers:

Item	Scheduled Manufacturer	Approved Equal
Continuous Hinges	ZERO (ZE)	McKinney, Stanley
Electric Powers Transfer	Von Duprin (VON)	Markar, Monarch
Pivots	DORMA (DM)	Rixson
Hinges	PBB (PBB)	Stanley, McKinney
Flush Bolts	Trimco (TR)	Burns, Ives
Locksets	DORMA (DM)	(Or approved equal)
Door Closers	DORMA (DM)	Norton, LCN
Overhead Stops	DORMA (DM)	Rixson, GJ,
Stops	Trimco (TR)	Burns, Ives
Push Pulls	Trimco (TR)	Rockwood
Weatherstripping	Zero (ZE)	Pemko, National Guard
Silencers	Trimco (TR)	Burns, Ives
Bottom Rail Deadlock	Adams Rite (AR)	(Or approved equal)
Cylinders & Keying	DORMA (DM)	(Or approved equal)

D. HARDWARE SETS

HW SET: 1

3	EA	HINGES	BB81 4.5 x 4.5 x US32D	PBB
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
1	EA	STOP	W1211 x US32D	TR
3	EA	SILENCERS	SR64	IVE

HW SET: 1A

3	EA	HINGES	BB81 4.5 x 4.5 x US32D	PBB
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
1	EA	CLOSER	8916AF x ALUM	DM
1	EA	STOP	W1211 x US32D	TR
3	EA	SILENCERS	SR64	IVE

HW SET: 1B

3	EA	HINGES	BB51 4.5 x 4.5 x US32D	PBB
1	EA	STOREROOM LOCK	ML9080CLGA x US32D	DM
1	EA	CLOSER	8916AF x ALUM	DM
1	EA	STOP	1270WV x US32D	TR
3	EA	SILENCERS	SR64	IVE
			PROVIDE WEATHERSTRIPPING & WEATHER SWEEPS AT DOOR BOTTOM	

HW SET: 1C

3	EA	HINGES	BB81 4.5 x 4.5 x US32D	PBB
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
1	EA	OVERHEAD STOP	910S SERIES x US26D	TR
3	EA	SILENCERS	SR64	IVE

HW SET: 2

1	EA	CONTINUOUS HINGE	910DBAA	ZE
1	EA	CLASSROOM LOCK	M9070CLGA x US32D	DM
1	EA	CLOSER/STOP	8916DS x ALUM	DM
1	EA	Set WEATHERSTRIP	429A JAMBS/HEAD	ZE
1	EA	DOOR BOTTOM	8193A	ZE
1	EA	SADDLES	566A	ZE

HW SET: 3

3	EA	HINGES	BB51 4.5 x 4.5 x US32D	PBB
1	EA	ELECTRIC LOCK	M9080EURXCLGA x US32D	DM
1	EA	CLOSER/STOP	8916IS x ALUM	DM
1	EA	POWER TRANSFER	EPT10 x SP28	VD
1	EA	DOOR CONTACT	(By others)	
1	EA	CARD READER	(By others)	
1	EA	POWER SUPPLY	(By others)	

3	EA	SILENCERS	SR64 PROVIDE WEATHERSTRIPPING & WEATHER SWEEPS AT DOOR BOTTOM	IVE

ALL WIRING AND CONNECTIONS BY DIVISION 16.
OPERATIONAL DESCRIPTION:
IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK ELECTRIC LOCK AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR POSITION SWITCH CONNECTED TO BUILDING'S SECURITY SYSTEM.

HW SET: 4

6	EA	HINGES	BB51 4.5 x 4.5 x US32D	PBB
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
1	EA	CLOSER/STOP	8916IS x ALUM	DM
2	EA	FLUSH BOLTS	W3917 x US26D	TR
1	EA	DUSTPROOF STRIKE	3910 x US26D	TR
2	EA	SILENCERS	SR64	IVE
1	EA	ASTRAGAL	(by door manufacturer) PROVIDE WEATHERSTRIPPING & WEATHER SWEEPS AT DOOR BOTTOM	

HW SET: 4A

6	EA	HINGES	BB81 4.5 x 4.5 x NRP x US32D	PBB
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
2	EA	FLUSH BOLTS	W3917 x US26D	TR
1	EA	DUSTPROOF STRIKE	3910 x US26D	TR
2	EA	SILENCERS	SR64	IVE
1	EA	ASTRAGAL	(by door manufacturer)	

HW SET: 5

2	EA	CYLINDERS	(TO SUIT)	DM

THE DOOR MANUFACTURER WILL FURNISH BALANCE OF HARDWARE.

HW SET: 6

2	EA	FLOOR CLOSERS	BTS80G x US26D	DM

2	EA	Sets PUSH PULLS	DH130 x US32D	BL
2	EA	STOPS	W1211 x US32D	TR
1	EA	SADDLE	(See details)	

HW SET: 7

1	EA	FLOOR CLOSER	BTS80G x US26D	DM
1	EA	Set PUSH PULLS	DB130 x US32D	BL
2	EA	CYLINDERS	(To suit) x US26D	DM
1	EA	OVERHEAD STOP	910S series x US26D	DM
1	EA	SADDLE	(See details)	

HW SET: 7A

1	EA	FLOOR CLOSER	BTS80G x US26D	DM
1	EA	set PUSH PULLS	DH130 x US32D	BL
1	EA	STOP	W1211 x US32D	TR
1	EA	SADDLE	(See details)	

HW SET: 8

3	EA	HINGES	BB81 4.5 x 4.5 x NRP x US32D	PBB
1	EA	CLASSROOM LOCK	M9070CLGA x US32D	DM
1	EA	CLOSER/STOP	8916DS x ALUM	DM
3	EA	SILENCERS	SR64	IVE

HW SET: 9

3	EA	HINGES	BB81 4.5 x 4.5 x US32D	PBB
1	EA	LATCHSET	M9010LLGA x US32D	TR
1	EA	CLOSER	8916AF x ALUM	DM
1	EA	DOOR STOP	W1211 X US32D	TR
3	EA	SILENCERS	SR64	IVE

HW SET: 10

3	EA	HINGES	BB81 4.5 x 4.5 x US32D	PBB
1	EA	LOCKSET	M9966CLGA x US32D	DM
1	EA	CLOSER/STOP	8916DS x ALUM	DM
3	EA	SILENCERS	SR64	IVE

HW SET: 11

3	EA	HINGES	BB81 4.5 x 4.5 x US32D	PBB
1	EA	LOCKSET	M9046CLGA x US32D	DM
1	EA	CLOSER	8916AF x ALUM	DM
1	EA	DOOR STOP	W1211 X US32D	TR
3	EA	SILENCERS	SR64	IVE

HW SET: 12

1	EA	PIVOT SET	OP750 x US26D	DM
1	EA	INTERMEDIATE PIVOT	75220 x US26D	DM
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
1	EA	CLOSER	8916AF x ALUM	DM
1	EA	DOOR STOP	W1211 X US32D	TR
1	SET	WEATHERSTRIPPING	328A JAMBS/HEAD	ZE
1	EA	DOOR BOTTOM	8193A	ZE
1	EA	SADDLE	(See details)	

Note: FURNISH EXTENDED SPINDLE, CYLINDER TO SUIT CLADDING.

HW SET: 13

2	EA	PIVOT SET	OP750 x US26D	DM
2	EA	INTERMEDIATE PIVOT	75220 x US26D	DM
1	EA	STOREROOM LOCK	M9080CLGA x US32D	DM
2	EA	CLOSER	8916AF x ALUM	DM
1	EA	DOOR STOP	W1211 X US32D	TR
2	EA	FLUSH BOLTS	W3917 x US26D	TR
1	SET	WEATHERSTRIPPING	328A JAMBS/HEAD	ZE
1	SET	ASTRAGAL SEALS	328A JAMBS/HEAD	ZE
2	EA	DOOR BOTTOM	8193A	ZE
1	EA	SADDLE	(See details)	

Note: FURNISH EXTENDED SPINDLE, CYLINDER AND STRIKE TO SUIT CLADDING.

HW SET: 14

ALL HARDWARE WILL BE FURNISHED BY THE MILLWORKER.

HW SET: 15

1	SET	PIVOTS	CP440 x US26D	DM
1	EA	BOTTOM RAIL LOCK	MS1861 x 4066 x SP28	AR
1	EA	CYLINDER	(TO SUIT)	DM
1	EA	ANGLE STOP	1217S x US26D	TR
1	EA	EDGE PULL	1062 x US26D	TR

HW SET: 16

2	SET	PIVOTS	CP440 x US26D	DM
2	EA	BOTTOM RAIL LOCK	MS1861 x 4066 x SP28	AR
2	EA	CYLINDER	(TO SUIT)	DM
1	EA	ANGLE STOP	1217P x US26D	TR
2	EA	EDGE PULL	1062 x US26D	TR

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 088000

GLASS AND GLAZING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the glass and glazing as shown on the drawings and/or specified herein, including but not limited to glazing of the following:

1. Clerestory.
2. Curtain walls.
3. Vestibule walls.
4. Vestibule soffit.
5. Interior doors, sidelights and office storefront.
6. Exterior doors in curtain walls.
7. Windows in curtain walls.
8. Decorative glass mounted to wall behind café counter.

1.3 RELATED SECTIONS

A. Hollow metal doors and frames - Section 081113.

B. Glazed curtain walls - Section 084113.

C. Framed mirrors - Section 102800.

1.4 REFERENCES

A. Comply with the recommendations of the following references unless more stringent requirements are indicated herein.

1. FGMA Publications: FGMA Glazing Manual.
2. AAMA Publications: AAMA TIR-A7 Sloped Glazing Guidelines and Glass Design for Sloped Glazing.

3. LSGA Publications: LSGA Design Guide.

4. SIGMA Publications: TM-3000 Vertical Glazing Guidelines and TB-3001 Sloped Glazing Guidelines.

5. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201.

6. Fire-Resistive Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

7. Fire-Resistive Glazing Products for Window Assemblies: Products identical to those tested per ASTM E 163, labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

8. 16 CFR 1201, Safety Standards for Architectural Glazing, Sealed Insulating Glass Manufacturing Association.

9. ASTM C 920, Elastomeric Joint Sealant.

10. Insulating Glass Criteria - IGCC International Glass Cert. Council.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads as required by NYC Building Code without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thicknesses indicated on drawings and/or specified herein are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Specified Design Wind Loads: 30 psf or greater if required by Code.

2. Probability of Breakage for Vertical Glazing:

   a. 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   b. 1 lite per 1000 for lites installed 15 degrees from the vertical land and under wind action.
   c. Load Duration: 60 seconds or less.

3. Maximum Lateral Deflection: For glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/100 times the short side length or 0.5", whichever is less.

4. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   a. Temperature Change (Range): 120 deg. F ambient; 180 deg F, material surfaces.

5. Thermal Solar Performance: See Article 2.2 herein.

C. Glass units shall be annealed, heat strengthened, fully tempered or laminated where required to meet wind and/or snow loads and safety glazing requirements, as shown, specified or recommended by the glass fabricator and as required by the prevailing Building Code.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's printed product data, specifications, standard details, glazing instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements, including performance requirements.

B. Submit compatibility and adhesion test reports from sealant manufacturer indicating materials were tested for compatibility and adhesion with glazing sealant, as well as other glazing materials including insulation units.

C. Initial Selection Samples: Submit samples of each glass and glazing material specified in construction documents.

1. Submit complete range of samples of standard colors and patterns for ceramic frits at insulating glass.

2. Submit complete range of samples of sandblasted glass showing variations of grits and opacity achieved.

D. Verification Samples: Submit representative samples of each glass and glazing material that is to be exposed in completed work. Show full color ranges and finish variations expected. Provide glass samples having minimum size of 144 sq. in. and 6 in. long samples of sealants and glazing materials; all samples shall bear the name of the manufacturer, brand name, thickness, and quality.

E. Calculations: Provide wind load charts, calculations, thermal stress analysis, and certification of performance of this work. Indicate how design requirements for loading and other performance criteria have been satisfied. Document shall be signed and sealed by a Professional Engineer licensed in the State of New York.

F. Test Reports: Provide certified reports for specified tests.

G. Warranties: Provide written warranties as specified herein.

H. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Steel frames required for work in this Section shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

1. For all exterior glazing, provide the following glazing performance information:

a. Visible Light Transmittance
b. U-value
c. Solar Heat Gain Coefficient
d. Infiltration
e. Thermally broken frames

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.8 QUALITY ASSURANCE

A. Source: For each glass and glazing type required for work of this Section, provide primary materials which are products of one manufacturer. Provide secondary or accessory materials which are acceptable to manufacturers of primary materials.

B. Installer: A firm with a minimum of three years' experience in type of work required by this Section and who is properly trained by manufacturers of primary materials; and with a successful record of in-service installations similar in size and scope to this Project.

C. Glass Thickness: Glass thicknesses shown on drawings and/or specified herein are minimum thicknesses. Determine and provide size and thickness of glass products that are certified to meet or exceed performance requirements specified in this Section.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."

2. IGMA Publications: IGMA TM-3000, "Vertical Glazing Guidelines for Sealed Insulating Glass Units."

E. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

F. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

H. Insulating Glass Certification Program: Permanently marked on spacers with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.

2. Associated Laboratories, Inc.

3. Insulating Glass Manufacturers Alliance.

I. Manufacturer shall be ISO 9001-2000 Certified.

1.9 TESTS

A. Preconstruction Sealant Test: Submit samples of materials to be used to glazing sealant manufacturer to determine sealant compatibility. Include samples of glass, gaskets, glazing materials, framing members, and other components and accessories of glazing work. Test in accordance with ASTM C 794 to verify what type of primers (if any) are required to ensure sealant adhesion to substrates.

1. Submit minimum of nine pieces of each type and finish of framing member, and nine pieces of each type, class, kind, condition, and form of glass, including monolithic, laminated, and insulating glass for adhesion tests.

2. Provide manufacturer's written report and recommendations regarding proper installation.

1.10 PROJECT CONDITIONS

A. Weather: Perform work of this Section only when existing or forecasted weather conditions are within limits established by manufacturers of materials and products used.

B. Temperature Limits: Install sealants only when temperatures are within limits recommended by sealant manufacturer, except, never install sealants when temperatures are below 40 deg. F.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations and GANA Manual.

1. Protect materials from moisture, sunlight, excess heat, sparks and flame.

2. Sequence deliveries to avoid delays, but minimize on-site storage.

1.12 WARRANTIES

A. General: Warranties shall be in addition to, and not a limitation of, other rights the City of New York may have under the Contract Documents.

B. Manufacturer's Special Project Warranty on Coated Glass Products: Provide written warranty signed by manufacturer of coated glass agreeing to furnish f.o.b. point of manufacture, within specified warranty period indicated below, replacements for those coated glass units which develop manufacturing defects. Manufacturing defects are defined as peeling, cracking or deterioration in metallic coating due to normal conditions and not due to handling or installation or cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty Period: Manufacturer's standard but not less than five (5) years after date of substantial completion.

C. Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of the hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance; provided the manufacturer's instructions for handling, installing, protecting and maintaining units have been complied with during the warranty period.

1. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of substantial completion.

D. Manufacturer's Special Project Warranty on Laminated Glass: Manufacturer's standard form, made out to City of New York and signed by laminated glass manufacturer agreeing to replace laminated glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty period five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/FABRICATORS

A. All glass and glazing used at the exterior of the Project shall be manufactured by the same manufacturer. The same manufacturer and the same furnace shall be used for all tempered and heat strengthened glass used throughout the project. Acceptable manufacturers include the following:

1. PPG Industries.
2. Guardian Industries.
3. Pilkington.
4. AFG.
5. JE Berkowitz, LP.
6. Viracon.

2.2 GLASS MATERIALS AND PRODUCTS

A. Clear Float Glass: ASTM C 1036, Type I (Transparent, Flat), Class 1 (Clear), Quality q3, minimum 1/4" thick.

B. Clear Tempered Glass: ASTM C 1048, Condition A (Uncoated), Type I (Transparent, Flat), Class 1 (Clear), Quality q3, Kind FT, minimum 1/4" thick. Tempered glass must be certified by SGCC to meet applicable standards. Tempered glass shall also conform to the following:

1. Length and Width: For 2.9 mm to 6.0 mm; +/-1.6 mm.
2. Diagonal: +/- 3.0 mm.
3. Edgework: Belt seaming or diamond wheels. 1.5 mm seam of upper and lower glass edges. No sharp edges.
4. Corners: No more than 3.0 mm from square.
5. Float Glass Defects: Must meet the requirements of ASTM C 1036. The most common defects are scratches, stones gaseous bubbles and edge chips. Tables in the glass standards have limits for size/quantity of defects.
6. Tempered glass shall have a minimum surface compression of 10,000 psi.
7. Tempered glass to be heat-treated by horizontal (roller hearth) process with inherent roller-wave distortion parallel to the bottom edge of the glass when installed.
8. Flatness Tolerances

a. Roller-Wave or Ripple: The deviation from flatness at any peak shall be targeted not exceed 0.003" as measured per peak to valley for 1/4" (6mm) thick glass.
b. Bow and Warp: The bow and warp tolerances shall not exceed 1/32" per linear foot.
c. Fully tempered glass shall be heat soaked to EN 14179-1:2005-European Heat Soaking Standard.

C. Provide high-performance, clear, metallic coating, equal to VE13-2M, as manufactured by Viracon. Provide glazing IGU which has the following performance characteristics:

1. ASHRAE U-Value

a. Winter: 0.25
b. Summer: 0.21

2. Shading Coefficient (SC): 0.44

3. Solar Heat Gain Coefficient (SHGE): 0.39

4. Light to Solar Gain Ratio (LSG): 1.87

D. Laminated Safety Glass: Provide two glass panes of equal thickness, laminated together with a polyvinyl butyl interlayer, conform to ASTM C 1172, and as follows:

1. Interlayer Color: Clear.

2. Interlayer Material: Provide Monsanto "Saflex" or DuPont "Butacite," 0.030" thick at vertical applications, and 0.060" thick at sloped or horizontal applications.

3. Minimum thickness of 1/4".

E. Insulating Glass: Insulated glass composition shall consist of minimum 1/4" clear exterior lite of float (or tempered, where required) glass with Low E coating on No. 2 face, minimum 1/2" argon filled air space and minimum 1/4" clear interior lite of float (or tempered, where required) glass. Provide factory assembled units of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space, complying with ASTM E 2190, and as follows:

1. Sealing System: Dual Seal.

2. Elastomeric Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT

3. Primary Sealant: Polyisobutylene.

4. Secondary Sealant: Silicone, General Electric IGS 3204 or IGS 3100, or Dow Corning 982.

a. For structurally glazed IG units, secondary seal shall conform to ASTM C 1249.

5. Primary and secondary seals shall not contain voids and must be continuously bonded to the glass structure.

6. Spacer: Clear finish aluminum with welded, soldered, or bent corners, hollow tube types, filled with low nitrogen absorption desicant.

7. Desiccant: Molecular sieve, silica gel, or blend of both.

8. Air Space Thickness: 1/2".

9. Glass Thickness: 1/4" minimum.

10. Units shall be certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) or by IGMA, and tested in accordance with the above ASTM Test Methods.

11. Insulating glass shall conform to the following tolerances:

    a. Length and Width: + 3.0 mm/ -2.0 mm.
    b. Diagonal: +/- 3.0 mm.
    c. Thickness: As agreed +/- 1.0 mm.
    d. Edge-Deletion of Coating: Minimum 8 mm wide. Width of deletion must be more than the width of the secondary seal. Silver layer(s) must be completely removed. Appearance must be uniform.
    e. Primary PIB Seal: Must be complete with no breaks. Appearance must be uniform. PIB bead must overlap coating. No visible bright line when glass is viewed in transmission. The width of the PIB bead shall be 4.0 mm + 3.0/ - 1.5 mm.
    f. Secondary Seal: Nominal 6 mm + 3.0/ - 1.5 mm. The minimum width of the secondary silicone seal for IG units that are glazed structurally must be determined according to ASTM C 1249. The secondary seal must be uniformly applied without bubbles, cavities or gaps. Avoid excess sealant that will need to be trimmed off later.

12. Additional requirements and properties for primary and secondary insulating glass seals and spacers:

    a. All glass units shall comply with IGMA Guidelines which limits the dimension of the visible edge seal encroachment into the vision area to be no greater than the "sightline infringement of 3mm (0.12").
    b. Insulating glass unit hermetic seal to consist of butyl primary and silicone secondary seals with bent, welded, or soldered interpane spacer corners; keyed corners are not acceptable unless also soldered or welded. Spacers shall be aluminum or stainless steel. Locate spacer joint at the top or sides of the units, but in no instances at the sill. Design units to minimize the number of spacer joints. Provide solid keys, embedded in butyl sealant on all four sides, at spacer joints.
    c. Hermetic seals must be continuous and intimately bonded to both lites of glass. Provide primary seal of uniform depth with a nominal width of 1/8 to

3/16 in. Hermetic seals shall not be contaminated with debris, fingerprints, or other foreign matter and shall not contain voids or air pockets that decrease the width of the seal below the minimum widths listed in these Specifications, or that breach the seal. The width of the primary seal shall not be less than 1/16 in., and the total cumulative length of the primary seal between 1/16 in. and 1/8 in. shall be less than 12 in. in any one insulating glass unit. The primary seal shall not have a reduced thickness at the corners. An increased thickness of the primary seal at the corners is acceptable.

d. Provide secondary seal of uniform depth with a nominal width of 1/4 in. Provide a total width of the primary and secondary seal of 1/2 in. Units shall carry CBA rating as established by ASTM E774 and shall meet SIGMA 65-7-2, latest edition. Units shall not contain breather or capillary tubes or similar penetrations.

2.3 GLAZING MATERIALS AND PRODUCTS

A. General: Provide sealants and gaskets with performance characteristics suitable for applications indicated. Ensure compatibility of glazing sealants with insulating glass sealants, with laminated glass interlayers, and with any other surfaces in contact.

B. General Glazing and Cap Bead Sealant: Provide sealant with maximum Shore A hardness of 50. Provide one of the following:

1. Dow Corning 795.
2. General Electric Silglaze N 2500 or Contractors SCS-1000.
3. Tremco Spectrem 2.
4. Or Approved Equal

C. Weather Seal Sealant: Provide non-acid curing sealant with movement range $\pm$ 50%, ASTM C 719. Provide one of the following:

1. Dow Corning 795.
2. General Electric Silpruf.
3. Tremco Spectrem 2.
4. Or Approved Equal

D. Backer Rod: Closed cell non-gassing polyethylene rod with rod diameter 25% wider than joint width.

E. Dense Elastomeric Compression Seal Gaskets: Provide molded or extruded neoprene or EPDM gaskets, Shore A hardness of 75 ± 5 for hollow profile, and 60 ± 5 for solid profiles, ASTM C 864.

F. Cellular, Elastomeric Preformed Gaskets: Provide extruded or molded closed cell, integral-skinned neoprene, Shore A 40±5, and 20% to 35% compression, ASTM C 509; Type II.

G. Preformed Glazing Tape: Provide solvent-free butyl-polyisobutylene rubber with 100% solids content complying with ASTM C1281 AAMA A 800 with integral continuous EPDM shim. Provide preformed glazing tape in extruded tape form. Provide Tremco "Polyshim II" or approved equal.

H. Setting Blocks: Provide 100% or silicone blocks with Shore A hardness of 80-90. Provide products certified by manufacturer to be compatible with silicone sealants. Length to be not less than 4". Width for setting blocks to be 1/16" more than glass thickness and high enough to provide the lite recommended by glass manufacturer. When thickness of setting block exceeds 3/4" the glass manufacturer must be consulted for sizes and configuration. In a vented system, setting block shall be designed so as to not restrict the flow of water within the glazing rabbet to the weep holes.

1. Shims: For shims used with setting blocks, provide same materials, hardness, length and width as setting blocks.

2. Structural Silicone Glazing: Provide silicone setting blocks where structural silicone occurs at sills and at insulating units with silicone edge seals.

I. Edge Blocks: Provide neoprene or silicone as required for compatibility with glazing sealants. Provide blocks with Shore A hardness of 55±5.

J. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place.

K. Miscellaneous Glazing Materials: Provide sealant backer rods, primers, cleaners, and sealers of type recommended by glass and sealant manufacturers.

L. Aluminum Glazing Channels: Clear anodized.

2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

C. Grind smooth and polish exposed glass edges.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GENERAL GLAZING STANDARDS

A. Install products using the recommendations from the manufacturer of glass, sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those in the "GANA Glazing Manual".

B. Verify that Insulating Glass (IG) Unit secondary seal is compatible with glazing sealants.

C. Install glass in prepared glazing channels and other framing members.

D. Install setting blocks in rabbets as recommended by referenced glazing standards in GANA Glazing Manual" and "IGMA Glazing Guidelines".

E. Provide bite on glass, minimum edge and face clearances and glazing material tolerances recommended by "GANA Glazing Manual".

F. Provide weep system as recommended by "GANA Glazing Manual".

G. Set glass lites in each series with uniform pattern, draw, bow and similar characteristics.

H. Distribute the weight of glass unit along the edge rather than the corner.

I. Comply with manufacturers and referenced industry standards on expansion joint and anchors; accommodating thermal movement; glass openings; use of setting blocks, edge, face, and bite clearances; use of glass spacers; edge blocks and installation of weep systems.

J. Protect glass edge damage during handling and installation.

K. Prevent glass from contact with contaminating substances that result from construction operations, such as weld spatter, fireproofing or plaster.

L. Remove and replace glass that is broken, chipped cracked or damaged in any way.

3.4 GLAZING

A. Glazing channel dimensions, as indicated on Shop Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead. Install setting blocks at the one greater points of each lite along the horizontal mullion.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

K. Flush Glazing

1. If the butt joint in the metal framing is in the vertical direction, the glazier shall run the tape initially on the head and sill members going directly over this joint. Should the butt joint in the metal framing run horizontally, tapes must first be applied to the jambs so that it crosses over the joint.

2. Each tape section shall butt the adjoining tape and be united with a tool to eliminate any opening.

3. Do not overlap the adjoining length of tape or rubber shim as this will prevent full contact around the perimeter of glass.

L. Off-Set Glazing

1. Where the glazing legs are off-set, the difference in the rabbet width shall be compensated by employing different glazing tapes with different diameter shims. The difference in shim shall be equal to the size of the off-set. The thinner tape shall be positioned first on the glazing leg closest to the interior. The thicker tape shall be cut to the exact length of the dimension between the applied tapes, and installed on the outermost glazing leg.

2. Immediately prior to setting glass, paper backing shall be removed. Apply a toe bead of sealant 6" in each direction, from each corner.

3. Locate setting blocks in the sill member at quarter points, or if necessary to within 6" of each corner. Setting blocks must be set equal distance from center line of the glass and high enough to provide the recommended bite and edge clearances.

4. Set edge block according to glass manufacturer's recommendations.

5. Set Glass: The glass shall be pressed firmly against the tape to achieve full contact.

6. In a vented system, apply a heel bead (air seal) of sealant around the perimeter of glass, between the sole of the I.G. unit and the base of the rabbet of the metal framing developing a positive bond to the unit and to the metal framing. The bead of the sealant shall be deep enough so that it will partially fill the channel to a depth of 1/4" between the glass edge and the base of the metal framing rabbet.

7. Interior stops shall be set, and glazing tape spline for the appropriate face clearance shall be rolled into place, compressing the glass to the shim within the glazing tape.

3.5 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant as recommended by glass manufacturer or glass frame manufacturer.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape where noted on approved shop drawings.

3.6 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.7 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

1. Exterior glazing gasket shall be set a minimum of 1/8" below exterior glazing stop to create a channel for sealant installation.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.8 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

F. Glass to be cleaned according to:

1. GANA Glass Information Bulletin GANA 01-0300 – "Proper Procedure for Cleaning Architectural Glass Products".

2. GANA Glass Informational Bulletin GANA TD-02-0402 – "Heat Treated Glass Surfaces are Different".

G. Do not use razor blades, scrapers or metal tools to clean glass.

3.9 GLASS SCHEDULE

A. GL-01 (Placeholder)

B. GL-02: 1 1/8" IGU at EAST/WEST CURTAINWALL & CLERESTORY

3/8" Exterior Lite, ½" Argon Filled Air Space, ¼" Interior Lite

Match Viracon Starfire Low Iron VE13-2M or approved equal

Fully Tempered both lites

Fixed Glazing

C. GL-03: 1 3/8" IGU at SOUTH CURTAIN WALL

3/8" Exterior Lite, 3/4" Argon Filled Air Space, ¼" Interior Lite

Match Viracon Starfire Low Iron VE13-2M or approved equal

Fully Tempered both lites

Fixed Glazing

D. GL-04: 1 3/8" IGU at VESTIBULE WALLS

1/4" Exterior Lite, 1/2" Argon Filled Air Space, 3/4" Interior Lite

Match Viracon Starfire Low Iron VE13-2M or approved equal

Fully Tempered both lites

Fixed Glazing

E. GL-05: 1 3/4" IGU at VESTIBULE SOFFIT

1/2" Exterior Lite, 1/2" Insulated Lamination, 3/4" Interior Lite

Match Viracon Starfire Low Iron VE13-2M or approved equal

LAMINATED SAFETY GLAZING

Provide Safety Glazing Labeling

Fixed Glazing

F. GL-06: 1/2" MONOLITHIC INTERIOR SAFETY GLAZING

INTERIOR GLAZING PARTITIONS & DOORS

Fully Tempered

Fixed and Operable Glazing

Provide Safety Glazing Labeling

G. GL-07: 1 1/8" IGU EXTERIOR DOORS, EXTERIOR OPERABLE WINDOWS AT CURTAIN WALL & VESTIBULE

3/8" Exterior Lite, ½" Argon Filled Air Space, ¼" Interior Lite

Match Viracon Starfire Low Iron VE13-2M or approved equal

Fully Tempered both lites

Operable Glazing

H. GL-08: (Placeholder)

I. GL-09: 1/4" MONOLITHIC SAFETY GLAZING

INTERIOR FINISH AT CAFÉ POD

100% Opaque Translucent White Silkscreen Finish

Fixed Glazing

Provide Safety Glazing Labeling

J. GL-10: 1" MONOLITHIC FULLY TEMPERED SAFETY GLAZING

STRUCTURAL GLASS FIN CURTAINWALL MULLIONS

Fully Tempered Safety Glazing

Fixed Glazing

Provide Safety Glazing Labeling

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 089000

LOUVERS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the louvers as shown on the drawings and/or specified herein, including, but not necessarily limited to, the following:

1. Aluminum louvers.

2. Blank off panels.

3. Bird screens.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Sealant work - Section 079200.

C. Louvers in metal doors - Section 081113.

D. Louvers connected to ductwork - Division 23.

1.4 REFERENCE STANDARDS

A. AAMA 2605 0 Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AMCA 500-L-99 – Laboratory Methods of Testing Louvers for Rating, Section 8.3.1 – Water Penetration Test.

C. AMCA 500-L-99 – Laboratory Methods of Testing Louvers for Rating, Section 8.3.2 – Wind Driven Rain Water Penetration Test.

D. ASTM B209-95 – Aluminum and Aluminum-Alloy Sheet and Plate, Specification for.

E. ASTM B221-95a – Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes, Specification for.

F. ASTM E90-97 – Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions, Specification for.

G. ASTM E 413-87 (Re-approved 1994) – Classification for Rating Sound Insulation, Specification for.

H. AWD D1.2-90 – Structural Welding Code – Aluminum.

I. NAAMM – Metal Finished Manual for Architectural and Metal Products.

J. Sheet Metal and Air Conditioning Contractors Association (SMACNA).

K. Society for Protective Coatings – SSPC – Paint 12: Cold Applied Asphalt Mastic (Extra Thick Film).

L. 29 CFR 1910.23 - Guarding Floor and Wall Openings and Holes.

1.5 QUALITY ASSURANCE

A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter or permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 30 lbf/sq. ft., acting inward or outward.

B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects.

1. Temperature Change (Range): 120 deg. F., ambient; 180 deg. F, material surfaces.

C. Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures, except as otherwise indicated.

D. Field Measurements: Verify size, location and placement of louver units prior to fabrication.

E. Shop Assembly: Coordinate field measurements and shop drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, certified test data, where applicable, and installation instructions for required products, including finishes.

B. Shop Drawings: Submit shop drawings for fabrication and erection of louver units and accessories. Include plans, elevations and details of sections and connections to adjoining work. Indicate materials, finishes, fasteners, joinery and other information to determine compliance with specified requirements.

C. Samples shall include color and finish samples for finish type required.

1. ML-01: Submit 24 inches x 24 inches sample for color.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Aluminum louvers shall contain a minimum of 70% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable."

1.8 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.9 WARRANTY

A. Finish shall be warranted for a period of 20 years, starting from date of Substantial Completion of the Project.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS.

A. Ruskin

B. Greenheck Fan Corporation

C. The Airolite Company

D. C/S Louvers

E. Arrow Louvers

F. American Warming and Ventilating (AWV)

2.2 MATERIALS

A. Drainable Fixed Aluminum Louver

1. Individual louver shall be fixed 45 degree, 6" deep drainable storm-proof blade of the following characteristics:

a. Frames and blades shall be aluminum, alloy 6063-T5, 0.081" thick.
b. Fasteners: 300 series stainless steel.

1). Provide types and lengths to suit unit installation conditions.

c. Perimeter angles (continuous), anchors and inserts of type, size and material required for type of loading and installation indicated. Provide Type 316 stainless steel perimeter angles, anchors and inserts for exterior installation and elsewhere as required for corrosion resistance.

2. Individual louver shall be 2" deep and assembled entirely from extruded aluminum components. Blades shall be inverted V-type and rated to resist water penetrtatyion under wind driven rain conditions.

a. Frames and blades shall be aluminum, alloy 6063-T5, 0.081" thick.
b. Fasteners: 300 series stainless steel.
1). Provide types and lengths to suit unit installation conditions.
c. Perimeter angles (continuous), anchors and inserts of type, size and material required for type of loading and installation indicated. Provide Type 316 stainless steel perimeter angles, anchors and inserts for exterior installation and elsewhere as required for corrosion resistance.

3. Submit test data on 4 feet by 4 feet louver units. Test data shall show the following results at 1100 fpm free area velocity.

a. Maximum Water Penetration: 0.005 oz.
b. Minimum Free Area (6"): 7.32 sq. ft.
c. Minimum Free Area (2"): 6.20 sq. ft.

4. Fabricate with continuous factory applied head and jamb closures.

5. Provide continuous preformed drain pan with drip edges. Provide custom drain pan where indicated on drawings.

B. Fixed, Acoustical Louvers

1. Extruded- or formed-metal frames and formed-metal blades filled on interior with mineral-fiber, rigid-board, acoustical insulation retained by perforated metal sheet, 45 degrees, 6-in. deep of the following characteristics:

a. Frames and blades shall be aluminum alloy, 6063-T5, 0.081-in. thick.
b. Standard Free Area: Not less than 4 sq. ft. (0.37 sq. m).
c. Airborne Sound Transmission Loss: STC 10 per ASTM E413, determined by testing per ASTM E90.

C. Louver Screens

1. General: Provide each exterior louver with louver screens complying with the following requirements:

a. Screen Location for Fixed Louvers: Interior face.
b. Screening Type: 1/2-in. mesh, 0.063-in. diameter aluminum bird screening, where indicated.

c. Screening Type: 18x14 mesh, 0.0123-in. 5056 alloy aluminum insect screening where indicated.

2. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6-in. from each corner and at 12-in. o.c.

3. Louver Screen Frames: Fabricate rewirable screen frames with mitered corners to louver sizes indicated and with the same kind and form of metal as indicated for louver to which screens are attached.

a. Finish: Same finish as louver frames to which louver screens are attached.

D. Blank-Off-Panels

1. Provide laminated metal-faced panels where indicated to seal off louver area not connected to ductwork, consisting of insulating core surfaced on back and front with metal sheets.

a. Thickness: 2-in.
b. Metal Facing Sheets: Aluminum sheet, 0.032-in. thick.
c. Insulating Core: Extruded-polystyrene insulation board complying with ASTM C578, Type VII.
d. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames 0.081-in. (2.06 mm) thick, with corners mitered and with same finish as panels.
e. Finish: Same as finish applied to louvers.
f. Attach blank-off panels to back of louver frames with 300 series stainless steel sheet-metal screws.

E. Aluminum Sills: Provide sill extensions (continuous) made of 0.125-in. thick aluminum where indicated. Color and finish of sills to match louver.

F. Automated Insulated Ventilation Louvers: Provide CDTI-50BF Low temperature control damper, foam injected thermally isolated damper, by Ruskin or approved equal.

1. Frame: 6 inches x 1 inch x 0.125 inch minimum 6063-T5 extruded aluminum hat shaped channel, assembled using corner clips welded to damper frame for rigidity. Damper frame shall be thermally isolated using two separate thermal cuts with polyurethane resin filled pockets.

2. Blades: 0.075 inch minimum 6063-T5 extruded aluminum, 6 inches wide maximum, airfoil-shaped, parallel action, horizontal orientation.

3. Thermal transfer

a. Both sides of blade shall be isolated from each other eliminating thermal transfer.
b. Damper blade overlap and thermal break shall be oriented to eliminate thermal transfer from 1 side of blade skins to other.

c. No downstream blade skin shall be exposed to upstream temperatures or conditions.

4. Linkage: Concealed in equal flanged frame.

5. Axles: Minimum 1/2 inch (13 mm) diameter plated steel, hex-shaped, mechanically locked internally into blade.

6. Bearings: Pressure-molded low temperature Lexan bearings.

7. Seals:

   a. Blade: Low temperature extruded Ruskiprene II with flame and smoke rating of 25/50. Mechanically attached to blade edge.
   b. Jamb: Polycarbonate.

8. Control Shaft: Removable, 1/2 inch diameter shaft extends 6 inches beyond frame.

9. Mounting: Horizontal

10. Temperature Rating: -70 to 200 degrees F.

11. Finish: Mill aluminum.

12. Assembly: Factory assemble low temperature control damper, actuator, options, and accessories, and furnish as a single factory-calibrated unit.

13. Performance Data:

   a. Total Leakage, AMCA 500: Based on pressure differential of 4 inches w.g.
      1). Damper 12 Inches x 12 Inches: 4 cubic feet per minute.
      2). Damper 60 Inches x 72 Inches: 120 cubic feet per minute.
   b. Pressure Drop: Maximum 0.090 inch w.g. at 1,000 feet per minute across 24 inch x 24 inch damper mounted in-duct.

14. SPH2 Auxiliary Switch by Ruskin or approved equal.

15. Removable aluminum grille at interior room side: 2 inches deep, Model EG100 by Ruskin or approved equal.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate and install metal louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames and supports, noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fasteners and anchors.

1. Wind Load: Uniform pressure (velocity pressure) of 30 lbf per sq. ft. acting inwards or outwards.

2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

   a. Temperature Change (Range): 100 deg F (55.5 deg C)

B. Air-Performance, Water-Penetration and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of height and width indicated according to Air Movement and Control Association (AMCA) Standard 500.

C. Airborne Sound Transmission Loss: Provide acoustical louvers complying with airborne sound transmission loss rating specified, as demonstrated by testing manufacturer's stock unit according to ASTM E90.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

C. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finished.

D. High-Performance Organic Coating Finish: AA-C12C42R1x. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluorpolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2

   a. Color and gloss as indicated in Louver Schedule herein.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where louvers are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages which are to be embedded in masonry construction. Coordinate the delivery of such items to the project site.

3.3 INSTALLATION

A. Locate and place louver units plumb, level and in proper alignment with adjacent work.

B. Use concealed anchorages wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as indicated.

D. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes and prime coats of paint so that there is no evidence of corrective work. Return items which cannot be refinished in the field to the shop, make the required alterations, and refinish the entire unit, or provide new units, at Contractor's option.

E. Protect aluminum surfaces from corrosion by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.

F. Provide concealed gaskets, flashings, joint fillers and insulations, and install as the work progresses to make the installations weathertight.

G. Mount bird screens and insect screens of all louvers unless indicated otherwise on inside face with clips, machine screw into frames. Screws shall be 300 series stainless steel.

H. Repair finishes damaged by fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in the field to the shop, make required alterations and refinish entire unit or provide new units and at no addition cost to the City.

I. Restore louvers and vents damaged during installation and construction period so that no evidence remains of correction work. If results of restoration are unsuccessful, remove damaged units and replace with new units and at no additional cost to the City.

3.4 LOUVER SCHEDULE

A. ML-01: Metal Louver at Clubhouse; EHH-601 by Greenheck or approved equal.

1. Material: Aluminum

2. Finish: High-Performance Organic Coating Finish

3. Color: To match PE-01

4. Gloss: 30% gloss to match PE-01

B. ML-02: Metal Louver at Clubhouse; EHH-201 by Greenheck or approved equal.

1. Material: Aluminum

2. Finish: High-Performance Organic Coating Finish

3. Color: To match PE-01

4. Gloss: 30% gloss to match PE-01

C. Automated Insulated Ventilation Louvers in ceiling cavity around café area: Low Temperature Control Damper, CDTI-50BF by Ruskin or approved equal.

1. Material: Aluminum

2. Finish: Mill

END OF SECTION

SECTION 092400

EXTERIOR LATH AND PLASTER

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor materials, equipment, and services necessary to complete the lath and plaster as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Suspended metal lath and suspension system.

2. Portland cement lime stucco plaster for exterior soffits.

3. Accessories.

1.3 RELATED SECTIONS

A. Steel deck - Section 053100.

B. Lightgage metal framing - Section 054000.

C. Cement board sheathing - Section 092900.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers: For actual installation of lath and plaster, use only skilled journeyman plasterers with a minimum 3 years' experience who are completely familiar with the referenced standards and with the requirements for this work.

B. Standards

1. Comply with ASTM C 926, Specifications for Application of Portland Cement Based Plaster.

2. Comply with ASTM C 1063, Specifications for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster.

3. Comply with minimum standards of ASTM C 847, Standard Specification for Metal Lath, galvanizing shall be G90 coating.

4. Comply with ASTM B 69 Standard Specification for Rolled Zinc.

5. National Lime Assoc. recommendations and standards.

6. Portland Cement Assoc. Plasterer's Manual.

C. Allowable Tolerances: For flat surfaces, do not exceed 1/8" in 10'-0" for bow or warp of surface, and for plumb or level.

D. Plaster ceiling and soffit assemblies shall be fabricated and installed so that deflection of plaster surfaces does not exceed L/360.

1.5 SUBMITTALS

A. Materials List: Before any lath and plaster materials are delivered to the job site, submit to the Commissioner a complete list of all materials proposed to be furnished and installed under this portion of the Work, Samples of all accessories, and copies of the manufacturer's current recommendations as to methods and installation.

B. Shop Drawings: Submit shop drawings of furring and lathing framing and control joint locations. Shop drawings shall detail the installation of lath, including lath discontinuity, lath fastening and fastener support requirements.

C. Samples: Submit 12" x 12" sample panels of plaster showing finish described herein including each color required.

1.6 PRODUCT HANDLING

A. General

1. Deliver all manufactured products to the site in their original unopened containers with all labels intact and legible at the time of use.

2. Do not permit scattering of materials or equipment but use all means necessary to ensure neatness of the site and structure at all times.

3. Perform all cleaning of tools and equipment only in the areas set aside for that purpose.

B. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades. Store all materials off the ground

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.7 JOB CONDITIONS

A. Do not apply plaster when ambient temperature is less than 32 deg. F., or when less than 40 deg. F. and falling.

B. In hot weather (above 75 deg. F.) protect cement plaster from direct sunlight and wind until fully cured.

C. Protect contiguous work from soiling, spattering, moisture, deterioration and other harmful effects which might result from plastering.

PART 2 PRODUCTS

2.1 METAL PRODUCTS

A. Lath For Suspended Soffits: Provide galvanized steel, large opening diamond mesh lath weighing 3.4 lbs. per sq. yd., complying with ASTM C 847 with G90 galvanized steel coating.

B. Main Carrying Channels (for Soffit): Provide 1-1/2" cold rolled galvanized steel carrying channels weighing 475 lbs. per 1000 lin. ft. Space channels 3'-0" o.c.

C. Furring Channels (for Soffit): Provide 3/4" cold rolled galvanized steel furring channels weighing 300 lbs. per 1000 lin. ft. Space furring channels 16" o.c.

D. Hangers and Supports

1. Hangers shall be 1" x 3/16" galvanized steel flats or 1/4" galvanized rods spaced 4'-0" o.c.

2. Hanger Anchorage Devices: Galvanized steel screws, clips, bolts, cast-in-place concrete inserts or other devices applicable to the method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3 x calculated hanger loading except size direct pull-out concrete inserts for 5 x calculated hanger loading.

3. Provide 18 ga. galvanized wire ties for lathing and accessories.

E. All galvanizing shall be hot-dip galvanizing conforming to ASTM A 653, G90 coating.

2.2 ACCESSORIES

A. Two-Piece Control Joints: Manufacturer's standard roll formed pair of zinc alloy casing beads with modified back flanges providing positive slip joint action and dust barrier, adjustable for joint width variation of 1/8" to 5/8".

B. Casing Beads: Provide expanded flange beads at all plaster terminations of zinc alloy material; conforming to ASTM B 69, manufactured by U.S. Gypsum Co. or approved equal.

C. Other Accessories: Provide furring brackets, fasteners and other accessories for complete plaster installation fabricated of galvanized steel meeting standards noted above.

1. Fasteners shall be hot dip galvanized steel self-drilling screws for attaching to metal.

D. Soffit Vent: Series LD, 3" dia. aluminum soffit vents with insect screen made by Midget Louver Inc. (203) 866-2342 or approved equal; aluminum to have Kynar 500 finish in color selected by the Commissioner.

2.3 PORTLAND CEMENT/LIME STUCCO SYSTEM

A. Materials

1. Portland Cement: ASTM C 150, Types 1.

2. Hydrated Lime: ASTM C 206, Type S.

3. Aggregate (sand): ASTM C 144 with the following gradation:

Sieve Size #	Percentage Passing Each Sieve
8	100%
16	60-90%
30	35-70%
50	10-30%
100	0-5%

4. Water: All water must be fit to drink.

B. Assembly: For scratch and brown coat mixes conform to ASTM C 926; add "Acryl 60" made by Thoro or approved equal acrylic admixture to both coats using 1:3 mix (1 part acrylic admixture to 3 parts water).

1. Finish Coat Mix: Factory prepared stucco finish containing all necessary materials except water.

2. Unacceptable Additives: Do not use air entraining admixtures in any stucco mixes.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where lath and plaster is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION OF METAL LATH AND SUPPORT SYSTEM FOR SOFFITS

A. Where lathing and metal support system abuts building structure horizontally, and where partition/wall abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading into the work from the building structure. Install slip or cushion type joints to absorb deflections and maintain lateral support.

1. Frame both sides of control and expansion joints independently and do not bridge joints with furring and lathing or accessories.

B. Install supplementary framing, blocking and bracing where required to support fixtures, grilles, etc., within plaster soffits.

C. Splicing Members: Lap furring members 8" and runner channels 12", and wire-tie near each end of lap. Splice plastering accessories by use of concealed splines, anchored to prevent offsets.

D. Space main carrying channels 3'-0" o.c.; level channels to a tolerance of 1/8" in 12'-0" and space hangers along channels 3'-0" o.c.

E. Secure hangers to channels and to overhead supports to comply with referenced standards.

F. Wire tie furring channels to main carrying channels 16" o.c. Install metal lath to furring channels by wire-tying or clipping to furring channels in accordance with industry standards.

G. Install furring and lathing plumb, level and true to line with a tolerance of 1/8" in 10'-0" and in accordance with industry standards. Space expansion joints as indicated on drawings.

H. Metal lath shall be applied with the long dimension of the sheet across the supports. Lap sheets not less than 2" at sides and not less than 3" at ends. End laps shall occur only at supports. Secure lath to supports 6" o.c. max. Provide a tie in side laps at each support and midway between supports.

3.3 INSTALLATION OF PLASTERING ACCESSORIES

A. Anchor accessories to the plaster base or substrate 8" o.c. along each flange, by wire tying to lath.

B. Miter or cope exposed portions of accessory items at corners, and install with tight joints. Spline splices to avoid off-sets; conceal splines.

C. Set exposed accessories plumb, level and true to line, with a tolerance of 1/8" in 10'-0". Shim as required and align units with adjoining work in a manner which will produce the best possible visual effect.

D. Install metal casing beads where shown and at the following locations:

1. At openings and terminations of plaster finish where otherwise edge of plaster would be exposed.

2. Where plaster abuts adjacent wall.

3. Where plaster abuts other finish, and termination is not lapped by other finish.

E. Install control joints where indicated on approved shop drawings; space control joints in accordance with ASTM C 1063. Control joints shall limit the maximum panel area to 144 sq. ft. with a maximum aspect ratio of 2 to 1.

1. Mount control joint flanges by 18 ga. wire-ties to the lath only.

3.4 GENERAL PLASTERING REQUIREMENTS

A. Mechanically mix plaster materials at the project site; do not hand mix except where small amounts are needed, using less than one bag of plaster material.

B. Sequence plaster installation properly with the installation and protection of other work, so that neither will be damaged by the installation of other work.

C. Cut out and replace all unbonded spots. Build in the work of others and do all cutting and patching of plaster in this connection. Where abutting other built-in materials, plaster shall be finished tightly against them and be neatly trimmed.

D. Repair surface defects. Surfaces shall be within 1/32" to 1/16" of true plane.

3.5 CEMENT LIME STUCCO APPLICATION

A. Environmental Conditions: Where there is not danger of freezing for a period of 48 hrs. after application and surface temperature can be maintained at 50 deg. F. during the hydration period, stucco work may proceed.

B. Portland Cement Plaster

1. Portland cement plaster/lime stucco shall be thoroughly mixed and worked in small batches, and after mixing it shall be allowed to stand until initial set is about to begin, when it shall be reworked just prior to application.

2. Scratch coat shall be full and approx. 3/8" thick, applied with sufficient force to form good keys. Scratch coat shall be evenly cross-scratched upon attaining its initial set.

   a. Surface mist the scratch coat with water four (4) times daily for 72 hours after application.

3. Brown coat shall be applied after the scratch coat has set. Apply with sufficient force to ensure tight contact with scratch coat. Thickness of brown coat shall be approx. 3/8". Bring brown coat to a true and even surface by floating or rodding. The brown coat shall be lightly scratched and broomed, shall be kept moist by surface misting with water four (4) times daily for 48 hours after application

4. Finish coat shall not be applied until the brown coat has seasoned for 7 days. Just before application of the finish coat, the brown coat shall again be evenly moistened with a fog spray for 48 hours. Thickness of finish coat shall be sufficient to secure texture required, but not less than 1/8".

   a. After stirring to a homogeneous consistency, the finish shall be applied to the entire wall surface in a continuous application.
   b. Finish shall be trowel or spray applied per manufacturer's application instructions.
   c. Finish shall be moist cured immediately after placement as per ASTM C926.
   d. No additives shall be added under any circumstances.
   e. Furnish color and texture to match approved sample.

5. Total thickness of plaster shall be no less than 1".

3.6 CUTTING AND PATCHING

A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore work, free from cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, and excessive crazing defects, including areas of the work which do not comply with specified tolerances, and where bond to the substrate has failed.

B. Sand plaster lightly to remove trowel marks and arrises.

3.7 CLEANING AND PROTECTION

A. Promptly remove plaster from surfaces which are not to be plastered. Repair floors, walls and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 092900

GYPSUM DRYWALL

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the gypsum drywall as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Gypsum board work for partitions, ceilings, column enclosures, furring, and elsewhere where gypsum drywall work is shown on drawings.

2. Gypsum sheathing and cement board back-up sheathing.

3. Metal supports for gypsum drywall construction.

4. Acoustical insulation for gypsum drywall work.

5. Sealant for gypsum drywall work.

6. Concealed metal reinforcing for attachment of railings, toilet partitions and other items supported on drywall partitions and walls.

7. Taping and finishing of drywall joints.

8. Installing rings and frames in drywall surfaces for grilles, registers and lighting fixtures.

9. Gypsum wallboard cants at beams and other projections over 2" deep in elevator shafts where adjoining wall is of gypsum wallboard construction.

10. Gypsum shaftwall construction.

11. Bracing and connections.

1.3 RELATED SECTIONS

A. Thermal insulation - Section 072100.

B. Hollow metal door frames - Section 081113.

C. Access doors - Section 083113.

D. Painting - Section 099000.

E. Rings for grilles, registers and light fixtures - Division 23 and 26.

1.4 QUALITY ASSURANCE

A. The following standards, as well as other standards which may be referred to in this Section, shall apply to the work of this Section:

1. The Gypsum Construction Handbook, latest edition, USG.

2. Construction Guide, latest edition, National Gypsum.

3. ASTM A 568 "Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements For"

4. ASTM C 475 "Standard Specification for Joint Treatment Materials For Gypsum Wallboard Construction"

5. ASTM C 645 "Standard Specification for Non-Structural Steel Framing Members"

6. ASTM C 754 "Standard Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products"

7. ASTM C 840 "Standard Specification for Application and Finishing of Gypsum Board"

8. ASTM C 919 "Standard Specification for Use of Sealants in Acoustical Applications"

9. ASTM C 954 "Standard Specification for Steel Drill Screws For the Application of Gypsum Board or Metal Plaster Bases to Steel Studs From 0.033 in. to 0.112 in. in Thickness"

10. ASTM C 1002 "Standard Specification for Steel Self-Piercing Tapping Screws For the Application of Gypsum Board"

11. ASTM C 1177 "Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing"

12. ASTM C 1178 "Standard Specification for Glass Mat Water Resistant Gypsum Backing Board"

13. ASTM C 1278 "Standard Specification for Fiber-Reinforced Gypsum Panel"

14. ASTM C 1396 "Standard Specification for Gypsum Board"

15. ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber"

B. Allowable Tolerances: 1/32" offsets between planes of board faces, and 1/16" in 8'-0" for plumb, level, warp and bow.

C. System Design Load

1. Provide standard drywall wall assemblies designed and tested by manufacturer to withstand a lateral load of 5 lbs. per sq. ft. for the maximum wall height required, and with deflection limited to L/240 of partition height.

   a. Drywall assemblies with tile finish shall have a deflection limit of L/360.

2. Provide drywall ceiling assemblies designed, fabricated and installed to have a deflection not to exceed L/360.

D. Fire-Resistance Rating: Where gypsum drywall with fire resistance ratings are indicated, provide materials and installations which are identical with those of applicable assemblies tested per ASTM E 119 by fire testing laboratories, or to design designations in UL "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction, and compliant with UL Test #2079; criteria for cycle movement for all field height wall sections requiring allowance for vertical deflection within framing details.

E. Installer: Firm with not less than 3 years of successful experience in the installation of specified materials.

1.5 SUBMITTALS

A. Submit shop drawing for each drywall partition, furring and ceiling system showing size and gauges of framing members, hanger and anchorage devices, wallboard types, insulation, sealant, methods of assembly and fastening, control joints indicating column lines, corner details, joint finishing and relationship of drywall work to adjacent work.

B. Samples: Each material specified herein, 12" x 12", or 12" long, or in manufacturer's container, as applicable for type of material submitted.

C. Manufacturer's Literature: Submit technical and installation instructions for each drywall partition, furring and ceiling system specified herein, and for each fire-rated and sound-rated gypsum board assembly. Submit other data as required to show compliance with these specifications, including data for mold resistant joint compound.

D. Test Reports: This Contractor shall submit test report, obtained by drywall manufacturer, indicating conformance of drywall assemblies to required fire ratings and sound ratings.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Gypsum drywall shall contain a minimum of 5 percent post-consumer recycled content and 95 percent postindustrial recycled content, calculated by adding the post-consumer recycled content percentage to one-half of the post-industrial recycled content percentage (e.g. 5 percent post-consumer and 25 percent post-industrial). Certify the recycled content in accordance with the Submittal Requirements of this Section.

B. Steel framing and support members (wall and ceiling furring, ceiling framing) shall contain a minimum of 25 percent (by weight) recycled content. Certify the recycled content in accordance with the Submittal Requirements of this Section.

C. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

D. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 PRODUCT HANDLING AND PROTECTION

A. Deliver, store and handle drywall work materials to prevent damage. Deliver materials in their original, unopened containers or bundles, and store where protected from moisture, damage and from exposure to the elements. Store wallboard in flat stacks.

B. Protect wallboard from becoming wet.

1.8 ENVIRONMENTAL CONDITIONS

A. Provide and maintain minimum temperature of fifty-five (55) degrees F. and adequate ventilation to eliminate excessive moisture within the building in the area of the drywall work for at least twenty-four (24) hours, prior to, during and after installation of drywall work. Installation shall not start until windows are glazed and doors are installed, unless openings are temporarily closed. Space above suspended ceilings shall be vented sufficiently to prevent temperature and pressure build up.

1.9 JOB MOCK-UP

A. At a suitable location, where directed by the Commissioner, lay up a portion of a finished wall and ceiling demonstrating the quality of work, including finishing, to be obtained under this Section. Omit drywall boards in locations as directed by the Commissioner to show stud spacing and attachments; after acceptance, complete assembly.

B. Adjust the finishing techniques as required to achieve the finish required by the Commissioner as described in this Section of these specifications.

C. Upon approval of the mock-up, the mock-up may be left in place as a portion of the finished work of this Section.

D. All drywall work shall be equal in quality to approved mock-up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Gypsum Drywall Panels and Accessories: U.S. Gypsum Co., Georgia Pacific, Lafarge North America, or National Gypsum Co. meeting specification requirements are acceptable.

B. Acceptable Manufacturers for Metal Supports of Drywall Assemblies: Unless otherwise noted, provide products manufactured by Dietrich Metal Framing, Super Stud Building Products, Marino/Ware, Clark Western or approved equal.

2.2 METAL SUPPORTS

A. Metal Floor and Ceiling Runners

1. Channel Type: Formed from 20 U.S. Std. gauge (unless otherwise noted) galvanized steel, width to suit channel type metal studs. Use 20 ga. top runners with 1-1/4" minimum flanges.

2. Ceiling runners and head of wall connections at rated partitions shall conform to UL #2079 for cycle movement. Provide positive mechanical connection of framing to structure, allowing for vertical movement within connections. Minimum of 20 ga. galvanized steel for clips, 25 ga. galvanized steel for ceiling runners. Providing a friction free – anti-seizure movement capacity.

   a. As manufactured by the Steel Network, VertiClip or VertiTrack or equal made by Metal-Lite Inc.
   b. FireTrak (including stud clips) by FireTrak Corp. or equal made by Metal-Lite Inc.

3. "J" Type: Formed from 20 U.S. Std. gauge galvanized steel, 1" x 2-1/2" or 4" wide (to suit detail) x 2-1/4" (for shaft wall).

B. Metal Studs, Framing and Furring

1. Channel Type Studs: Channel type with holes for passage of conduit formed from minimum 20 U.S. Std. gauge (unless heavier gauge is required to meet deflection limits) galvanized steel, width as shown on drawings.

2. Furring Channels: Hat shaped, formed from galvanized steel, 25 U.S. Std. gauge.

3. "C-H," "CT," or "I" Type Stud: 1-1/2" x 2-1/2", 4" or 6" wide (to suit detail) galvanized steel. Use for shaft wall construction; gauge and size as required to meet deflection limits given herein.

4. Double "E" Type Stud or "J" Track with Holding Tabs: 1" x 2-1/2", 4" or 6" wide (to suit detail) galvanized steel. Use for shaft wall construction; gauge and size as required to meet deflection limits given herein.

5. Continuous 16 gauge x 8" wide steel wall plate screwed to studs as required for support of railings, toilet partitions and other items supported on drywall partitions and walls.

C. Suspended Ceiling and Fascia Supports

1. Main Runners: 1-1/2" steel channels, cold rolled at 0.475 lbs. per ft., rust-inhibitive paint finish.

2. Furring Members: Screw-type hat-shaped furring channels of 25 ga. zinc-coated steel; comply with ASTM C 645.

3. Hangers: Galvanized, 1" x 3/16" flat steel slats capable of supporting 5x calculated load supported.

4. Hanger Anchorages: Provide inserts, clips, bolts, screws and other devices applicable to the required method of structural anchorage for ceiling hangers. Size devices for 5x calculated load supported.

5. Furring Anchorages: 16 ga. galvanized wire ties, manufacturer's standard clips, bolts or screws as recommended by furring manufacturer.

D. All galvanized steel members shall have coating conforming to ASTM A 653, G60.

2.3 GYPSUM WALLBOARD TYPES

A. Gypsum Wall Board: 1/2" thick and 5/8" thick as indicated on drawings, "Sheetrock" by USG, or "Gold Bond" by National Gypsum, 48" wide, in maximum lengths available to minimize end-to-end butt joints.

B. Fire Rated Gypsum Wall Board: 1/2" thick and 5/8" thick as indicated on drawings, "Sheetrock Firecode C" by USG, "Firecheck Type C" by Lafarge, or "Gold Bond Fireshield" by National Gypsum, 48" wide, in maximum lengths available to minimize end-to-end butt joints.

C. Cement Board (for tile backer board where scheduled): ½" thick "Durock Tile Backer Board" by USG, "Wonder Board Lite" by Custom Building Products, or approved equal.

D. Water Resistant Backing Board for Tile Finish: 1/2" thick and 5/8" thick, 3' x 6', "Durock Tile Backer Board" by USG, "Dens-Shield Tile Backer Board" by Georgia Pacific, or "EXP Tile Backer Board" by National Gypsum. Cover joints with a pressure sensitive woven glass fiber tape equal to Imperial Type P Tape.

E. Moisture/Mold Resistant Gypsum Wall Board (for areas in toilet rooms, lockers, janitor's closets not scheduled to receive ceramic tile, or where fire rating is required): 1/2" thick and 5/8" thick as indicated on drawings, "Mold Tough," "Mold Tough FR," by U.S. Gypsum, "DensArmor Plus" by Georgia Pacific, Lafarge "Mold Defense" and/or Lafarge "Mold Defense Type X," or "Gold Bond EXP Interior Extreme Gypsum Board" by National Gypsum, 48" wide, in maximum lengths available to minimize end-to-end butt joints.

1. Board must have a rating of 10 per ASTM D 3273 with a core that meets ASTM C 1396, Section 6 or ASTM C 1658.

F. Mold Resistant Shaft Wall Liner: Solid gypsum board liner for shaft wall construction, 1" thick, 24" wide, as required to suit condition, by standard lengths as required, beveled edges. Provide "Mold Tough Liner Panel" by USG, "DensGlass Ultra Shaft Guard" by Georgia Pacific, Lafarge "Mold Defense Shaftliner Type X" and/or Lafarge "Weather Defense Shaftliner Type X", "Gold Bond Brand Fireshield Shaft Liner XP" by National Gypsum or "Gold Bond Brand EXP Extended Exposure Shaft Liner" by National Gypsum.

1. Liner board must have a rating 10 per ASTM D 3273 with a core that meets ASTM C 1396 Section 6.

G. Exterior Gypsum Wall Board for Soffits: 5/8" thick "USG Exterior Gypsum Ceiling Board," Lafarge "Soffitboard," or "Gold Bond Brand Exterior Soffit Board" by National Gypsum or equal conforming to ASTM C 1396, Section 8, and ASTM C 931.

H. Mold Resistant Paperless Wall Board (at all perimeter walls and wet shafts): 1/2" and 5/8" thick as indicated on drawings, 48" wide "DensArmour Plus" by Georgia Pacific, "Gold Bond Brand EXP Interior Extreme" by National Gypsum, or approved equal that has a rating of 10 per ASTM D 3273 with core that meets ASTM C 1396, Section 6 or ASTM C 1658.

I. Abuse Resistant Wallboard: 5/8" thick as indicated on drawings, "Fiberock Brand Panel VHI Abuse Resistant" by USG, "Dens Armor Plus Abuse Resistant Panels" by Georgia Pacific, Lafarge "Protects AR100," or "EXP Interior Extreme AR" by National Gypsum or "Gold Bond Brand Hi-Abuse XP" by National Gypsum, 48" wide, in maximum lengths available to minimize end-to-end butt joints.

1. Board must achieve a Level 1 rating per ASTM C 1629.

J. Impact Resistant Wallboard: 1/2" and 5/8" thick as indicated on drawings, "Fiberock Brand VHI Abuse Resistant Panel" by USG, "DensArmor Plus Impact-Resistant Panels" by Georgia-Pacific Gypsum, or "EXP Interior Extareme IR" by National Gypsum or "Gold Bond Brand Hi-Impact XP" by National Gypsum, 48" wide, in maximum lengths available to minimize end-to-end butt joints.

2.4 ACCESSORIES

A. Semi-Rigid Acoustical Insulation: Paper-less, non-combustible, semi-rigid mineral fiber mat, thickness as indicated on drawings, in walls (unless otherwise indicated), 3 lb./cu. ft. maximum density; Thermafiber LLC "Thermafiber," or approved equal.

B. Fasteners for Wall Board: USG Brand Screws; Type S Bugle Head for fastening wallboard to lighter gauge interior metal framing (up to 20 ga.). Type S-12 Bugle Head for fastening wallboard to heavier gauge interior metal framing (20 ga. to 12 ga.); Type S and Type S-12 Pan Head for attaching metal studs to door frames and runners; and Type G Bugle Head for fastening wallboard to wall board. Lengths specified below under "Part 3 - Execution" Articles and as recommended by drywall manufacturer.

1. For Portland cement base boards, fasteners shall be equal to Durock Steel Screws by U.S. Gypsum.

C. Laminating Adhesive: "Sheetrock Brand Joint Compound."

D. Metal Trim - Corner Beads: For 90 degree External Corners - "Dur-A-Bead" No. 103, 27 U.S. Std. ga. galvanized steel, 1-1/4" x 1-1/4", for 90 degree external corners.

E. Metal Trim - Edge Beads: "Sheetrock Brand Paper Faced Metal Bead and Trim."

F. Metal Trim Treatment Materials and Joint Treatment Materials for Gypsum Drywall Boards: Paper tape for joint reinforcing; Setting Type (Durabond 90) or Lightweight Setting Type Joint Compound for taping and topping; and Ready Mix Compound for finishing.

1. For mold-resistant drywall, water resistant drywall, and tile backer board, use glass mesh tape with setting joint compound that is rated 10 when tested in accordance with ASTM D 3273 and evaluated in accordance with ASTM D 3274. Acceptable joint compound is "Rapid Set One Pass" made by CTS Cement Manufacturing Corp. or "Rapid Joint" manufactured by Lafarge North America or approved equal meeting standards noted herein.

G. Control Joints: No. 0.093, USG.

H. Acoustical Sealant: USG "Acoustical Sealant" or "Tremco Acoustical Caulking" of Tremco Mfg. Co., or approved equal.

I. Neoprene Gaskets: Conform to ASTM D 1056.

2.5 GYPSUM SHEATHING AND RELATED ACCESSORIES

A. Gypsum Sheathing: 5/8" thick "Dens-Glass Fireguard," Type X, made by Georgia Pacific, "Securock Glass-Mat Sheathing" made by U.S. Gypsum Co., "Gold Bond EXP Extended Exposure Sheathing" made by National Gypsum Co., or approved equal, meeting ASTM C 1177, Type X.

B. Fasteners: 1-1/4" Type S-12 screws "Climaseal" (or approved equal) coated finish.

C. Joint Treatment: Provide a one-part high performance sealant conforming to ASTM C 920, Type S, Grade NS, Class 25 meeting with the approval of the air/vapor barrier manufacturer for compatibility; see Section 072700 for description. Apply a 3/8" bead of sealant to the joint and trowel flat. Apply enough of the same material to each fastener to cover completely when trowelled flat.

2.6 EXTERIOR CEMENT BOARD AND ACCESSORIES

A. Cement Board: "Durock Exterior Cement Board," 5/8" thick, made by U.S. Gypsum Co., or approved equal.

B. Fasteners: 1-1/4" Type S-12 Wafer Head, "Climaseal" (or approved equal) coated finish.

C. Joint Reinforcing: Manufacturer's 4" wide exterior joint tape as recommended for specified cement board product, open weave with pressure sensitive adhesive on one side.

D. Sealant: Same as noted above.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where gypsum drywall is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. General

1. Install drywall work in accordance with drywall manufacturer's printed instructions and as indicated on drawings and specified herein.

2. All metal framing for drywall partitions shall extend from floor to underside of structural deck above. Provide for vertical deflection with positive mechanical connections of framing members to structure.

3. Provide concealed reinforcement, 16 ga. thick by eight (8) inches wide or as detailed or as recommended by manufacturer, for attachment of railings, toilet partitions, and other items to be supported on the partitions which cannot be attached to the metal framing members. Concealed reinforcement shall span between metal studs and be attached thereto using two (2) self-tapping pan head screws at each stud.

   a. Back of drywall shall be scored or notched to prevent bulging out where reinforcement plate occurs.

B. Fire-Rated Assemblies: Install fire-rated assemblies in accordance with requirements of authorities having jurisdiction, Underwriters' Laboratories and test results obtained and published by the drywall manufacturer, for the fire-rated drywall assembly types indicated on the drawings.

C. Acoustic Assemblies: Install acoustic rated assemblies to achieve a minimum STC as noted on drawings, in accordance with test results obtained and published by the drywall manufacturer, for the drywall assembly type indicated on the drawings.

D. Sealant

1. Install continuous acoustical sealant bead at top and bottom edges of wallboard where indicated or required for sound rating as wallboard is installed, and between metal trim edge beads and abutting construction.

2. Install acoustical sealant in 1/8" wide vertical control joints within the length of the wall or partitions, and in all other joints, specified below under "Control Joints." Install bead of acoustical sealant around electric switch and outlet boxes, piping, ducts, and around any other penetration in the wallboard; place sealant bead between penetrations and edge of wallboard.

3. Where sealant is exposed to view, protect adjacent surfaces from damage and from sealant material, and tool sealant flush with and in same plane as wallboard surface. Sealant beads shall be 1/4" to 3/8" diameter.

E. Wall Board Application

1. Do not install wallboard panels until steel door frames are in place; coordinate work with Section 081113, "Steel Doors and Frames."

2. See drawings for all board types. Use fire-rated wallboard for fire-rated assemblies. Use water-resistant wallboard where indicated on drawings and where wallboard would be subject to moisture. Install water-resistant wallboard in full, large sheets (no scraps) to limit number of butt joints.

3. Apply wallboard with long dimension parallel to stud framing members, and with abutting edges occurring over stud flanges.

4. Install wallboard for partitions from floor to underside of structure above and secure rigidly in place by screw attachment, unless otherwise indicated.

5. Provide "Thermafiber" safing insulation meeting standards of Section 078413 at flutes of metal deck where partitions carry up to bottom of metal deck.

6. Neatly cut wallboard to fit around outlets, switch boxes, framed openings, piping, ducts, and other items which penetrate wallboard; fill gaps with acoustic sealant.

7. Where wallboard is to be applied to curved surfaces, dampen wallboard on back side as required to obtain required curve. Finish surface shall present smooth, even curve without fluting or other imperfections.

8. Screw fasten wallboard with power-driven electric screw driver, screw heads to slightly depress surface of wallboard without cutting paper, screws not closer than 3/8" from ends and edges of wallboard.

9. Where studs are doubled-up, screw fasten wallboard to both studs in a staggered pattern.

F. Cement Backer Board

1. General: Furnish cementitious backer board in maximum available lengths. Install horizontally, with end joints over framing members.

2. Fastening: Secure cementitious backer board to each framing member with screws spaced not more than 12 inches on center and not closer than 1/2" from the edge. Install screws with a conventional screw gun so that the screw heads are flush with the surface of the board.

3. Joint Treatment: Fill space between edge of backer and receptor with dry-set Portland cement or latex-Portland cement mortar. Fill all horizontal and vertical joints and corners with dry-set Portland cement or latex-Portland cement mortar. Apply fiberglass tape over joints and corners and embed with same mortar.

G. Metal Trim: Install and mechanically secure in accordance with manufacturer's instructions; and finish with three (3) coats of joint compound, feathered and finish sanded smooth with adjacent wallboard surface, in accordance with manufacturer's instructions.

1. Corner Beads: Install specified corner beads in single lengths at all external corners, unless corner lengths exceed standard stock lengths.

2. Edge Beads: Install specified edge beads in single lengths at all terminating edges of wallboard exposed to view, where edges abut dissimilar materials, where edges would be exposed to view, and elsewhere where shown on drawings. Where indicated on drawings, seal joint between metal edge bead and adjoining surface with specified gasket, 1/8" wide minimum and set back 1/8" from face of wallboard, unless other size and profile indicated on drawings.

3. Casing beads shall be set in long lengths, neatly butted at joints. Provide casing beads at juncture of board and vertical surfaces and at exposed perimeters.

H. Control Joint Locations: Gypsum board surfaces shall be isolated with control joints where:

1. Ceiling abuts a structural element, dissimilar wall or other vertical penetration.

2. Construction changes within the plane of the partition or ceiling.

3. Shown on approved shop drawings.

4. Ceiling dimensions exceed thirty (30) feet in either direction.

5. Wings of "L," "U," and "T" shaped ceiling areas are joined.

6. Expansion or control joints occur in the structural elements of the building.

7. Shaftwall runs exceed 30' without interruption.

8. Partition or furring abuts a structural element or dissimilar wall or ceiling.

9. Partition or furring runs exceed 30' without interruption.

10. Where control joints are required, ceiling height door frames may be used as control joints. Less than ceiling height frames shall have control joints extending to the ceiling from both corners.

I. Joint Treatment and Spackling

1. Joints between face wallboards in the same plane, joints at internal corners of intersecting partitions and joints at internal corners of intersections between ceilings and walls or partitions shall be filled with joint compound.

2. Screw heads and other depressions shall be filled with joint compound. Joint compound shall be applied in three (3) coats, feathered and finish surface sanded smooth with adjacent wallboard surface, in accordance with manufacturer's

instructions. Treatment of joints and screw heads with joint compound is also required where wallboard will be covered by finish materials which require a smooth surface, such as vinyl wall coverings.

3.3 FURRED WALLS AND PARTITIONS

A. Use specified metal furring channels. Run metal furring channel framing members vertically, space sixteen (16) inches o.c. maximum. Fasten furring channels to concrete or masonry surfaces with power-driven fasteners or concrete stub nails spaced sixteen (16) inches o.c. maximum through alternate wing flanges (staggered) of furring channel. Furring channels shall be shimmed as necessary to provide a plumb and level backing for wallboard. At inside of exterior walls, an asphalt felt protection strip shall be installed between each furring channel and the wall. Furring channel and splices shall be provided by nesting channels at least eight (8) inches and securely anchoring to concrete or masonry with two (2) fasteners in each wing.

B. Wallboard Installation: Same as specified under Article 3.4 - "Metal Stud Partitions."

3.4 METAL STUD PARTITIONS

A. Runner Installation: Use channel type. Align accurately at floor according to partition layout. Anchor runners securely sixteen (16) inches o.c. maximum with power-driven anchors to floor slab, with power-driven anchors to structural slab above. See "Stud Installation" below for runners over heads of metal door frames. Where required, carefully remove sprayed-on fireproofing to allow partition to be properly installed.

B. Stud Installation

1. Use channel type, positioned vertically in runners, spaced as noted on drawings, but not more than sixteen (16) inches o.c.

2. Anchor studs to floor runners with screw fasteners. Provide snap-in or slotted hole slip joint bolt connections of studs to ceiling runners leaving space for movement. Anchor studs at partition intersections, partition corners and where partition abuts other construction to floor and ceiling runners with sheet metal screws through each stud flange and runner flange.

3. Connection at ceiling runner for non-rated partitions shall be snap-in or slotted hole slip joint bolt connection that shall allow for movement. Seal studs abutting other construction with 1/8" thick neoprene gasket continuously between stud and abutting construction.

4. Connections for fire rated partitions at ceiling runners shall conform to UL Design #2079.

5. Install metal stud horizontal bracing wherever vertical studs are cut or wallboard is cut for passage of pipes, ducts or other penetrations, and anchor horizontal bracing to vertical studs with sheet metal screws.

6. At jambs of door frames and borrowed light frames, install doubled-up studs (not back to back) from floor to underside of structural deck, and securely anchor studs

to jamb anchors of frames and to runners with screws. Provide cross braces from hollow metal frames to underside of slab.

7. Over heads of door frames, install cut-to-length section of runner with flanges slit and web bent to allow flanges to overlap adjacent vertical studs, and securely anchor runner to adjacent vertical studs with sheet metal screws. Install cut-to-length vertical studs from runner (over heads of door frame) to ceiling runner sixteen (16) inches maximum o.c. and at vertical joints of wallboard, and securely anchor studs to runners with sheet metal screws.

8. At control joints, in field of partition, install double-up studs (back to back) from floor to ceiling runner, with 1/4" thick continuous compressible gasket between studs. When necessary, splice studs with eight (8) inches minimum nested laps and attach flanges together with two (2) sheet metal screws in each flange. All screws shall be self-tapping sheet metal screws.

C. Runners and Studs at Chase Wall: As specified above for "Runners" and "Studs" and as specified herein. Chase walls shall have either a single or double row of floor and ceiling runners with metal studs sixteen (16) inches o.c. maximum and positioned vertically in the runners so that the studs are opposite each other in pairs with the flanges pointing in the same direction. Anchor all studs to runner flanges with sheet metal screws through each stud flange and runner flange following requirements of paragraph 3.4, B. Provide cross bracing between the rows of studs by attaching runner channels or studs set full width of chase attached to vertical studs with one self-tapping screw at each end. Space cross bracing not over thirty-six (36) inches o.c. vertically.

D. Wallboard Installation - Single Layer Application (Screw Attached)

1. Install wallboard with long dimension parallel to framing member and with abutting edge joints over web of framing member. Install wallboard with long dimension perpendicular to framing members above and below openings in drywall extending to second stud at each side of opening. Joints on opposite sides of wall shall be arranged so as to occur on different studs.

2. Boards shall be fastened securely to metal studs with screws as specified. Where a free end occurs between studs, back blocking shall be required. Center abutting ends over studs. Correct work as necessary so that faces of boards are flush, smooth, true.

3. Wallboard screws shall be applied with an electric screw gun. Screws shall be driven not less than 3/8" from ends or edges of board to provide uniform dimple not over 1/32" deep. Screws shall be spaced twelve (12) inches o.c. in the field of the board and 8" o.c. staggered along the abutting edges.

4. All ends and edges of wallboard shall occur over screwing members (studs or furring channels). Boards shall be brought into contact but shall not be forced into place. Where ends or edges abut, they shall be staggered. Joints on opposite sides of a partition shall be so arranged as to occur on different studs.

5. At locations where piping receptacles, conduit, switches, etc., penetrate drywall partitions, provide non-drying sealant and an approved sealant stop at cut board locations inside partition.

E. Wallboard Installation - Double-Layer Application

1. General: See drawings for wallboard partition types required.

2. First Layer (Screw Attached): Install as described above for single layer application.

3. Second Layer (Screw Attached): Screw attach second layer, unless laminating method of attachment indicated on drawings or necessary to obtain required sound rating or fire rating. Install wallboard vertically with vertical joints offset thirty-two (32) inches from first layer joints and staggered on opposite sides of wall. Attach wallboard with 1-5/8" screws sixteen (16) inches o.c. along vertical joints and sixteen (16) inches o.c. in the field of the wallboard. Screw through first layer into metal framing members.

4. Second Layer (Laminated): Install wallboard vertically. Stagger joints of second layer from first layer joints. Laminate second layer with specified laminating adhesive in beads or strips running continuously from floor to ceiling in accordance with manufacturer's instructions. After laminating, screw wallboard to framing members with 1-5/8" screws, spaced twelve (12) inches o.c. around perimeter of wallboard.

F. Wallboard Installation - Laminated Application: Where laminated wallboard is indicated, use specified laminating adhesive, install wallboard vertically and maintain tolerances as specified for screw attached wallboard.

G. Insulation Installation: Install where indicated on drawings. Place blanket tightly between studs.

H. Deflection of Structure Above: To allow for possible deflection of structure above partitions, provide top runners for non-rated partitions with 1-1/4" minimum flanges and do not screw studs or drywall to top runner. Where positive anchorage of studs to top runner is required, anchorage device shall be by means of slotted hole (in clip connection with screw attachment to web of steel through bushings located in slots of clips), or other anchorage device approved by Commissioner.

I. Control Joints

1. Leave a 1/2" continuous opening between gypsum boards for insertion of surface mounted joint.

2. Back by double framing members.

3. Attach control joint to face layer with 9/16" galvanized staples six (6) inches o.c. at both flanges along entire length of joint.

4. Provide two (2) inch wide gypsum panel strip or other adequate seal behind control joint in fire rated partitions and partitions with safing insulation.

3.5 DRYWALL FASCIAS AND CEILINGS

A. Furnish and install inserts, hanger clips and similar devices in coordination with other work.

B. Secure hangers to inserts and clips. Clamp or bolt hangers to main runners.

C. Space main runners 4'-0" o.c. and space hangers 4'-0" o.c. along runners, except as otherwise shown.

D. Level main runners to a tolerance of 1/4" in 12'-0", measured both lengthwise on each runner and transversely between parallel runners.

E. Metal Furring Channels: Space sixteen (16) inches o.c. maximum. Attach to 1-1/2" main runner channels with furring channel clips (on alternate sides of main runner channels). Furring channels shall not be let into or come in contact with abutting masonry walls. End splices shall be provided by nesting furring channels no less than eight (8) inches and securely wire tying. At any openings that interrupt the furring channels, install additional cross reinforcing to restore lateral stability.

F. Mechanical accessories, hangers, splices, runner channels and other members used in suspension system shall be of metal, zinc coated, or coated with rust inhibitive paint, of suitable design and of adequate strength to support units securely without sagging, and such as to bring unit faces to finished indicated lines and levels.

1. Provide special furring where ducts are over two (2) feet wide.

G. Apply board with its long dimension at right angles to channels. Locate board butt joints over center of furring channels. Attach board with one (1) inch self-drilling drywall screws twelve (12) inches o.c. in field of board at each furring channel; eight (8) inches o.c. at butt joints located not less than 3/8" from edges.

3.6 SHAFT WALLS

A. Runner Installation: Use "J" metal runners at floor and ceiling, with the short leg toward finish side of wall. Securely attach runners to structural supports with power-driven fasteners at both ends and twenty-four (24) inches o.c.

B. Shaft Wall Liner: Cut shaft wall liner panels one (1) inch less from floor to ceiling height and erect vertically between J-runners.

C. C-H Studs: Cut metal studs 3/8" to not more than 1/2" less than floor to ceiling height and install between shaft wall liner panels so that panels are fitted snugly into the one (1) inch wide "H," "T," or "I" portion of the stud. Space studs twenty-four (24) inches o.c., unless otherwise indicated on drawings. Install full-length steel E-Studs or J-runners vertically at T-intersections, corners, door jambs, and columns. Install full length E-Studs or J-runners over shaft wall liner both sides of closure panels. Frame openings cut within a liner panel with J-Runner around perimeter. For openings, frame

with vertical E-Stud or J-runner at edges, horizontal runner at head and sill, and reinforcing as shown on the drawings. Suitably frame all openings to maintain structural support for wall. Over metal doors, install a cut to length section of runner and attach to strut-studs with clip angles and 3/8" Type S Screws space twelve (12) inches o.c.

D. Wallboard Installation - Double Layer Installation: Erect gypsum wallboard base layer vertically or horizontally to meet fire rating on one side of studs with end joints staggered. Fasten base layer panels to studs with one (1) inch Type S screws twenty-four (24) inches o.c. Caulk perimeter of base layer panels. Apply gypsum wallboard face layer vertically over base layer with joints staggered and attached with 1-5/8" Type S screws staggered from those in base, spaced eight (8) inches o.c. and driven into studs.

E. Wallboard Installation (Where Both Sides of Shaft Wall are Finished): Apply gypsum wallboard face layers vertically both sides of studs. Stagger joints on opposite partition sides. Fasten panels with one (1) inch or two (2) inches Type S screws spaced eight (8) inches o.c. in field and along edges into studs.

F. Where handrails are indicated for direct attachment to drywall shaft system, provide not less than a sixteen (16) ga. x eight (8) inches wide galvanized steel reinforcement strip, accurately positioned and secured to studs and concealed behind not less than one 1/2" thick course of gypsum board in the system.

G. Integrate stair hanger rods with drywall shaft system by locating cavity of system as required to enclose rods.

3.7 ERECTION AT COLUMN ENCLOSURES

A. Metal furring supports shall be provided under work of this Section, and shall be cut to lengths as necessary for tight fit such that spacing is not more than sixteen (16) inches o.c.

B. Board shall be fastened securely to supports with screws as specified. Place boards in position with minimum amount of joints. Where free ends occur between supports, back-blocking or furring shall be required. Center abutting ends over supports. Correct work as necessary so that faces of boards are flush, smooth and true. Provide clips or cross furring for attachment as required.

C. All layers shall be screw attached to furring.

D. When column finish called for on drawings to be in the same plane as drywall finish layer, maintain even, level plane.

3.8 INSTALLATION OF GYPSUM SHEATHING

A. Fasten sheathing to exterior of each stud with specified fasteners spaced 3/8" from ends and edges and approx. 8" o.c. at each stud. Install fasteners in accordance with manufacturer's recommendations using 2500-RPM maximum screw gun. Sheathing board shall be installed horizontally. Apply sealant between joints and trowel flush;

and apply sealant around sheathing perimeter and at interface with other materials. Cover fastener heads with sealant and trowel flush.

B. Refer to Section 072713 for air barrier description.

3.9 INSTALLATION OF CEMENT BOARD

A. Apply cement board panels horizontally with ends over supports. Fit ends and edges closely, but not forced together. Apply sealant around sheathing perimeter and at interface with other materials. Stagger end joints in successive courses.

B. Fasten cement board panels to framing with specified fasteners. Install fasteners in accordance with manufacturer's recommendations using 2500-RPM maximum screw gun. Drive fasteners in field of panels first, working towards ends and edges. Hold panel in firm contact with framing while driving fasteners. Space fasteners max. 8" o.c. along each stud with perimeter fasteners at least 3/8" from ends and edges. Drive screws so heads are flush with surface of panels, to provide firm panel contact with framing. Apply Durock Exterior Tape centered over all joints and corners.

C. Refer to Section 072713 for air barrier description.

3.10 FINISHING

A. Taping: A thin, uniform layer of compound shall be applied to all joints and angles to be reinforced. Reinforcing tape shall be applied immediately, centered over the joint, seated into the compound. A skim coat shall follow immediately, but shall not function as a fill or second coat. Tape shall be properly folded and embedded in all angles to provide a true angle.

B. Filling: After initial coat of compound has hardened, additional compound shall be applied, filling the board taper flush with the surface. The fill coat shall cover the tape and feather out slightly beyond the tape. On joints with no taper, the fill coat shall cover the tape and feather out at least four (4) inches on either side of the tape. No fill coat is necessary on interior angles.

C. After compound has hardened, a finishing coat of compound shall be spread evenly over and extending slightly beyond the fill coat on all joints and feathered to a smooth, uniform finish. Over tapered edges, the finished joint shall not protrude beyond the plane of the surface. All taped angles shall receive a finish coat to cover the tape and taping compound, and provide a true angle. Where necessary, sanding shall be done between coats and following the final application of compound to provide a smooth surface, ready for painting.

D. Fastener Depressions: Compound shall be applied to all fastener depressions followed, when hardened by at least two (2) coats of compound, leaving all depressions level with the plane of the surface.

E. Finishing Beads and Trim: Compound shall be applied to all bead and trim and shall be feathered out from the ground to the plane of the surface. When hardened, this shall be followed by two (2) coats of compound each extending slightly beyond the previous

coat. The finish coat shall be feathered from the ground to the plane of the surface and sanded as necessary to provide a flat, smooth surface ready for decoration.

F. Except as otherwise noted, level of finish for surface exposed to view shall conform to Level 4 of ASTM C 840 and GA-214 of the Gypsum Association.

1. For drywall boards with fiberglass facing, provide Level 5 finish of ASTM C840 and GA-214.

G. Drywall construction with defects of such character which will mar appearance of finished work, or which is otherwise defective, will be rejected and shall be removed and replaced at no expense to the City of New York.

3.11 CLEANING AND ADJUSTMENT

A. At the completion of installation of the work, all rubbish shall be removed from the building leaving floors broom clean. Excess material, scaffolding, tools and other equipment shall be removed from the building.

B. Work shall be left in clean condition ready for painting or wall covering. All work shall be as approved by Commissioner.

C. Cutting and Repairing: Include all cutting, fitting and repairing of the work included herein in connection with all mechanical trades and all other trades which come in conjunction with any part of the work, and leave all work complete and perfect after all trades have completed their work.

3.12 PROTECTION OF WORK

A. Installer shall advise Contractor of required procedures for protecting drywall work from damage and deterioration during remainder of construction period.

3.13 GYPSUM BOARD SYSTEMS SCHEDULE

A. CL-01: 5/8 inch gypsum board ceiling

B. WL-01: 1/2 inch gypsum board

C. WL-02: 5/8 inch fire rated gypsum board

D. WL-03: 1/2 inch cement board (tile backer board)

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 093000

CERAMIC TILE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the ceramic tile as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Ceramic mosaic floor tile.

2. Ceramic glazed wall tile and matching base.

3. Stone saddles.

4. Setting beds, grout, sealant and waterproofing membrane.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Masonry - Section 042000.

C. Gypsum drywall - Section 092900.

D. Quarry tile - Section 093310.

1.4 REFERENCES

A. ANSI A108 Series/A118 Series - American National Standards for Installation of Ceramic Tile.

B. ANSI A136.1 - American National Standards for Organic Adhesives for Installation of Ceramic Tile.

C. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

D. ASTM C 150 - Standard Specification for Portland Cement.

E. TCNA - Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America.

F. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.

G. Stone Tile – Conform to requirements of MIA (Marble Institute of America) Dimension Stone Design Manual.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work, and the recommendations contained in the referenced standards.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:

1. Manufacture all tile in accordance with Standard Grade Requirements of ANSI A-137.1.

2. Install all ceramic tile in accordance with the recommendations contained in Handbook for Ceramic, Glass and Stone Tile Installation of the Tile Council of North America, Inc., latest edition and ANSI A108/A118/A136.

1.6 SUBMITTALS

A. Samples

1. Before any ceramic tile is delivered to the job site, submit to the Commissioner sample panels, approx. 12" x 12", mounted on hardboard back-up with selected grout color for each color and pattern of ceramic tile and grout specified.

2. Submit 6" length of stone saddles.

3. Submit 12" x 12" samples of waterproofing membrane.

B. Master Grade Certificates: Prior to opening ceramic tile containers, submit to the Commissioner a Master Grade Certificate, signed by an officer of the firm manufacturing the ceramic tile used, and issued when the shipment is made, stating the grade, kind of tile, identification marks for tile containers, and the name and location of the project.

C. Mock-ups

1. At an area on the site where approved by the Commissioner, provide a mock-up ceramic tile installation.

a. Make the mock-up approximately 24" x 24" in dimension.
b. Provide one mock-up for each type, class, and color of installation required under this Section.
c. The mock-ups may be used as part of the Work, and may be included in the finished Work, when so approved by the Commissioner.
d. Revise as necessary to secure the Commissioner's approval.

2. The mock-ups, when approved by the Commissioner, will be used as datum for comparison with the remainder of the work of this Section for the purposes of acceptance or rejection.

3. If the mock-up panels are not permitted to be part of the finished Work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Ceramic tile shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal

of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.8 PRODUCT HANDLING

A. Delivery and Storage

1. Deliver all materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.

2. Store all materials under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at not less than 50 deg. F. in tiled areas during installation and for 7 days after completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS OF TILE

A. Provide tile manufactured by Stone Source, Daltile, Marazzi Tile or approved equal meeting these specifications. The Commissioner reserves the right to pick tile from any price group.

2.2 WALL TILE AND BASE

A. Wall Tile

1. CT-01: Ceramic Wall Tile, 6 inches by 6 inches glazed ceramic tile, Daltile Semi-Gloss, 0100 White.

2. GT-01: Glass Mosaic Wall Accent Tile, 1 inch by 1 inch clear glass tile, Glacier by Stone Source, in mix of colors as follows:

   a. ES02, Aqua Clear Finish
   b. ES04, Clear
   c. ES23, Turquoise Clear Finish

3. PT-02: Porcelain Wall Tile, 2 inches by 2 inches porcelain tile, Gypsum by Bianco Angelico, Semi Gloss finish, White.

B. Provide sanitary cove base to match wall tile.

2.3 FLOOR TILE

A. PT-01: Porcelain Floor Tile, 2 inches by 2 inches porcelain tile, Architech Forest by Stone Source, matt finish, Grey, non-slip to meet ADA requirements.

2.4 TRIM AND SPECIAL SHAPES

A. Provide external and internal corners, trim shapes at openings, and all other trim and special shapes to match the tile specified herein, as required by field conditions and drawing details.

2.5 STONE SADDLES

A. Provide sound stone saddles as selected by the Commissioner, minimum 3/4" thick, with an abrasive hardness of not less than 10.0, when tested in accordance with ASTM C 241. Cut saddle to fit jamb profile, honed finish.

2.6 MORTAR BED, BOND COAT AND GROUT

A. Portland Cement: ASTM C 150, Type I.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144, clean and graded natural sand.

D. Reinforcing for Mud Set Systems: 2" x 2" x 16/16 ga. welded wire mesh.

E. Latex Admixture for Mortar Bed

1. MAPEI, Planicrete AC, blended with a 3:1 site mix.

2. Laticrete 333.

3. Pro Spec – Acrylic Additive.

4. Custom Building Products – Flex Thin Set Additive.

F. Latex – Portland Cement Bond Coat, complying with ANSI A118.4 and ISO 13007, C2ES2P2.

1. MAPEI, Keralastic System thin set mortar, consisting of Kerabond dry-set mortar and Keralastic latex admixture.

2. Laticrete; 211 dry-set mortar and 4237 latex admixture.

3. Pro Spec – Permalastic System consisting o Permalastic Dryset Mortar and Permalastic Admixture

4. Custom Building Products – Mega Flex Crack Prevention Mortar.

G. Wall and Base Tile

1. Over drywall use ANSI A136.1-1967 Organic Adhesive for installation of Ceramic Tile, Type I and ISO 13007 D2TE. Shear strength shall be 50 psi minimum. Adhesive primer as recommended by adhesive manufacturer. Manufacturer shall certify, in writing, that adhesive and primer used are proper types for the intended tile types and application. Conform to TCA Detail W-242.

   a. MAPEI Type 1 Mastic.
   b. Laticrete Type 1 Adhesive.
   c. ProSpec Blood Adhesive.
   d. Custom Building Products Relia Bond Adhesive

2. Over masonry and concrete use a mortar bed leveling coat conforming to ANSI A108.1A followed by a Latex Portland Cement Bond Coat, MAPEI, Kerabond/Keralastic System, Custom Building Products Mega Flex or equal by Laticrete or Pro Spec, conforming to ANSI A118.4, ISO 13007-C2ES2P2, and TCA Detail W-211.

3. Over cement board use a Latex Portland cement mortar bond coat, MAPEI, Kerabond/Keralastic System, Custom Building Products Mega Flex, or approved equal by Laticrete or Pro Spec, conforming to ANSI A118.4, ISO 13007-C2ES2P2, and TCA Detail W-244; coat back of board with waterproof membrane as specified below.

4. Over glass mat water resistant gypsum backer board use a Latex Portland cement mortar bond coat, MAPEI, Kerabond/Keralastic System, or approved equal by Laticrete or Pro Spec, conforming to ANSI A118.4, ISO 13007-C2ES2P2, and TCA Detail W-245.

H. Floor Tile and Stone Saddle - Thin Set: Set floor tile and stone saddle using latex modified Portland Cement mortar, Basis of Design, MAPEI, Kerabond/Keralastic System, conforming to ANSI A118.4, ISO 13007-C2ES2P2, and TCA Detail F-113.

I. Waterproofing Membrane complying with ANSI A118.10 and ANSI A118.12; and having IAPMO certification as a shower pan liner: "Mapelastic AquaDefense" by MAPEI with factory blended "Bio-Block Antimicrobial", "Laticrete 9235 with

Microban" made by Laticrete International, ProSpec B6000 or Custom Building Products 9240.

1. Reinforce membrane with polyester fabric.

J. Water: Clean, fresh and suitable for drinking.

K. Grout complying with A118.7; and ISO 13007, CG2WAF : For grouting ceramic tile, provide a commercial Portland cement grout "Ultracolor Plus" (additive not required) made by MAPEI or Laticrete Sanded Grout with required Latex Additive or Custom Building Products Prism Sure Color Grout; color as selected by the Commissioner. Add latex additive to grout made by same manufacturer as grout.

L. Physical Properties: The setting beds and grouts must meet the following physical requirements:

1. Compressive Strength – 3000 psi min.

2. Shear Bond Strength – 500 psi min.

3. Water Absorption – 4.0% max.

4. Service Rating (ASTM C 627) – Extra Heavy Duty.

M. Sealer: Seal all grout joints and all unglazed tile using water-based penetrating sealer; "Sealer's Choice 15 Gold" by Aqua Mix Inc., or approved equal.

N. Temporary Protective Coating: Either product indicated below that is applied in the tile manufacturer's factory and formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, applied hot, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg. F. per ASTM D 87.

2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

O. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, equal to "Concentrated Stone & Tile Cleaner" made by Aqua-Mix or approved equal, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 SEALANT

A. Joint Backing: Preformed, compressible, resilient, non-extruding, non-staining strips of foam neoprene, foam polyethylene, or other material recommended by sealant manufacturer.

B. Bond Breaker: Polyethylene tape, 3 mils thick or other material recommended by sealant manufacturer.

C. Sealant Primer: Colorless, non-staining, or type to suit substrate surface, as recommended by sealant manufacturer.

D. Sealant: One-part silicone based sanitary sealant, conforming to ASTM C 920, Type S, Grade NS, Class 25. Sealant hardness upon full cure shall be between 20-30 Shore "A" Durometer. Color of sealant to blend with or match adjacent materials, and as selected by the Commissioner. Sealant shall be equivalent to 1700 Sanitary Sealant made by General Electric or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where ceramic tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels

1. Floors: + 1/8" in 10'-0" distance and 1/4" total max. variation from levels shown.

B. Grind or fill concrete and masonry substrates as required to comply with allowable variations.

3.3 PREPARATION

A. Coordinate the following with Section 033000:

1. Steel trowel and fine broom finish concrete slabs that are to receive ceramic tile. Cure concrete slabs that are to receive tile before tile application. Do not use liquid curing compounds or other coatings that may prevent bonding of tile setting materials to slabs. Slab shall be dry at time of tile installation.

B. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of setting bed. Rinse with water to remove all traces of treatment. Surface must meet finish requirements as noted in ANSI 108.01.

C. Blending: for tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at project site before installing.

D. Field Applied Temporary Protective Coating: Pre-coat tile with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.4 JOINTS IN TILE WORK

A. Joint Widths: 1/16" wide in ceramic tile.

B. Alignment: Wall, base and floor joints shall align through the field and trim. Direction and location of all joints as directed by Commissioner.

C. Movement Joints: Conform to TCA Detail EJ171. Locate where movement joints are in back-up material. Provide movement joint at joints between mop receptors and ceramic tile. Provide movement joint at all vertical internal joints of wall tile. Movement joints 1/8" wide in ceramic tile. Fill all movement joints with specified backing and sealant. Use bond breaker where sufficient space for joint backing does not exist.

1. Provide sealant between ceramic tile and plumbing fixtures, mirrors, pipes, countertops and other dissimilar materials penetrating or adjacent to ceramic tile.

3.5 INSTALLATION

A. Comply with the following installation standards

1. Wall tile over drywall using organic adhesive - ANSI A136.1 and ISO 13007, D2TE.

2. Wall tile over cement board or glass mat backer board using dry set mortar with latex additive - ANSI A118.4 and ISO 13007, C2ES2P2.

3. Wall tile over masonry or concrete using dry set mortar with latex additive - ANSI A118.4 and ISO 13007, C2ES2P2.

4. Floor tile using full mud set mortar - ANSI A118.4 and ISO 13007, C2ES2P2.

5. Floor tile using dry set mortar with latex additive - ANSI A118.4 and ISO 13007, C2ES2P2.

6. Floor tile over waterproofing membrane.- ANSI A118.4 and ISO 13007, C2ES2P2.

B. All setting beds and/or adhesives shall provide for an average contact area of not less than 95% coverage.

C. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignment shown.

1. Floors: 1/8" in 10'-0" run, any direction; +/- 1/8" at any location; 1/32" offset at any location.

2. Walls: 1/8" in 8'-0" run, any direction; 1/8" at any location; offset at any location, 1/32".

3. Joints: +/- 1/32" joint width variation of any location; 1/16" in 3'-0" run deviation from plumb and true.

D. Waterproofing Membrane

1. Install the membrane in strict accordance with manufacturer's written recommendations.

2. Upon completion of work, test horizontal membrane for leaks by plugging the drain or damming areas and filling with water for a period of 48 hours minimum. Inspect for leakage. Make necessary adjustments to stop all leakage and retest until watertight. If membrane is not covered by another surface immediately, provide protection until membrane is covered.

E. Handle, store, mix and apply setting and grouting materials in compliance with the manufacturer's instructions.

F. Extend tile work into recesses and under equipment and fixtures, to form a complete covering without interruptions. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

G. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Fit tile closely to electrical outlets, piping and fixtures so that plates, collars, or covers overlap tile.

H. Lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls and trim are the same size. Lay out tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.

I. All cut tile that is visible shall be honed smooth.

J. All corners shall have mitered tile unless noted otherwise, all miters shall be honed smooth

K. Tile to be aligned or set back from face of adjacent door frames and finshes typical.

3.6 INSTALLATION OF STONE SADDLES

A. Install stone saddles cut to profiles and sizes shown, accurately fitted to jambs, coped at stops, set in full bed of mortar herein specified, and with grouted edge joints as specified for floor tile.

3.7 CLEANING AND PROTECTION

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use cleaners only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures

from effects of cleaning. Flush surfaces with clean water before and after cleaning to insure removal of all cleaning material.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Apply coat of sealer to all grout joints and all unglazed tile.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings from tile surfaces.

E. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 093310

QUARRY TILE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the quarry tile as shown on the drawings and/or specified herein, including, but not limited to the following:

1. Quarry tile floor and matching base.

2. Setting beds, grout, sealant and waterproofing membrane.

1.3 RELATED SECTIONS

A. Concrete slab - Section 033000.

B. Masonry - Section 042000.

C. Drywall - Section 092900.

D. Ceramic tile - Section 093000.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing and grouting of quarry tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work and the recommendations contained in the referenced standards and are "TITC Certified".

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:

1. Manufacture all quarry tile in accordance with Standard Grade Requirements of ANSI A-137.1.

2. Install all quarry tile in accordance with the recommendations contained in Handbook for Ceramic, Glass and Stone Tile Installation of the Tile Council of North America, Inc., latest edition and ANSI A108/A118/A136.

1.5 SUBMITTALS

A. Samples

1. Before any quarry tile is delivered to the job site, submit to the Commissioner sample panels, approx. 12" x 12", mounted on hardboard back-up for each color and pattern of quarry tile specified.

B. Master Grade Certificates: Prior to opening quarry tile containers, submit to the Commissioner a Master Grade Certificate, signed by an officer of the firm manufacturing the tile used, and issued when the shipment is made, stating the grade, kind of tile, identification marks for tile containers, and the name and location of the project.

C. Submit independent test reports indicating that setting beds and grout conform to the physical requirements specified herein.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the

submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Quarry tile shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 PRODUCT HANDLING

A. Delivery and storage

1. Deliver all materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.

2. Store all materials under cover in a manner to prevent damage and contamination; store only the specified materials at the job site.

B. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at not less than fifty (50) degrees F in tiled areas during installation and for seven (7) days after completion.

PART 2 PRODUCTS

2.1 TILE

A. Provide tile manufactured by Daltile, American-Olean, Metropolitan Ceramics, Summitville Tiles Inc., or approved equal meeting these specifications. The Commissioner reserves the right to pick tile from any price group.

B. QT-01: Quarry Tile – Daltile OQ62-BR, 6 inches by 6 inches by 7/16 inch thick unglazed abrasive quarry tile with a carborundum additive.

C. Provide trim, cove base and special shapes as required for complete installation of same material, size, color and finish of field tile.

2.2 MORTAR BED, BOND COAT AND GROUT

A. All products shall be factory prepared; there shall be no on-site mixing of Portland cement and sand.

B. Portland Cement: ASTM C 150, Type 1.

C. Hydrated Lime: ASTM C 207, Type S.

D. Sand: ASTM C 144, clean and graded natural sand.

E. Reinforcing: 2" x 2" x 16/16 gauge galvanized welded wire mesh.

F. Latex Additive for Mortar Bed:

1. MAPEI, Planicrete AC.

2. Laticrete 333.

3. ProSpec – B710 Mortar Additive

4. Custom Flex Thin Set Additive.

G. Latex-Portland Cement Bond Coat:

1. MAPEI, Keralastic System consisting of Kerabond dry-set mortar and Keralastic latex admixture or

2. Laticrete, 211 dry-set mortar and 4237 latex admixture.

3. MAPEI, Granirapid System consisting of Granirapid Powder and Granirapid Liquid (for rapid setting requirements).

4. Laticrete, 211 dry-set mortar and 4237 latex admixture and 101 rapid setting admixture.

5. ProSpec Permalastic System consisting of Permalastic Dryset Mortar and Permalastic Admixture.

6. Custom Building Products, Porcelain Tile Thin Set Mortar.

7. Custom Building Products, Mega Lite R/S Crack Prevention Mortar.

H. Waterproofing Membrane (with Fabric):

1. MAPEI, Mapelastic 400.

2. Laticrete 9235.

3. ProSpec B6000.

4. Custom Building Products, 9240.

I. Base Tile

1. Over drywall use ANSI A136.1-1967 Organic Adhesive for installation of Ceramic Tile, Type 1. Shear strength shall be 50 psi minimum. Adhesive primer as recommended by adhesive manufacturer. Manufacturer shall certify, in writing, that adhesive and primer used are proper types for the intended tile types and application. Conform to TCA Detail W-202.

2. Over masonry and concrete use a mortar leveling coat followed by a Dry-Set Latex modified Portland Cement Bond Coat conforming to TCA Detail W-211.

J. Floor Tile - Mud Set: Set floor tile using latex modified Portland Cement bond coat conforming to TCA Detail F-121.

K. 100% Solids Epoxy Grout (meeting 118.3):

1. MAPEI Keropoxy IEG.

2. Laticrete 2000.

3. Custom Building Products, 100% Solid Epoxy.

4. ProSpec B7000.

5. Color selected by the Commissioner.

L. Physical Properties: The setting beds and grouts must meet the following physical requirements:

1. Compressive Strength - 3000 psi min.

2. Shear Bond Strength - 500 psi min.

3. Water Absorption - 4.0% max.

4. Service Rating (ASTM C 627) - Extra Heavy Duty.

2.3 SEALANT AND ACCESSORIES

A. Joint Backing: Preformed, compressible, resilient, non-extruding, non-staining strips of foam neoprene, foam polyethylene or other material recommended by sealant manufacturer.

B. Sealant: Two part polyurethane sealant, self-leveling, conforming to Fed. Spec. TT-S-00227E, Class A, Type 1, equal to "THE/900" made by Tremco or approved equal.

PART 3 EXECUTION

3.1 CONDITION OF SURFACES

A. Examine the areas and conditions where quarry tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 CONDITION OF SURFACES

A. Allowable Variations in Substrate Levels

1. Floors: +/-1/8" in 10'-0" distance and 1/4" total maximum variation from levels shown.

B. Grind or fill concrete substrates as required to comply with allowable variations.

3.3 PREPARATION

A. Etch concrete substrate as may be required to remove curing compounds or other substances that would interfere with proper bond of setting bed. Rinse with water to remove all traces of treatment. Surface must meet finish requirements per ANSI 108.01.

B. Seal substrate with sealer as recommended by manufacturer of mortar or adhesive.

3.4 JOINTS IN TILE WORK

A. Joint Widths: 1/4" wide in quarry tile.

B. Alignment: Base and floor joints shall align through the field and trim. Direction and location of all joints shall be as directed by the Commissioner.

C. Provide expansion joints where tile abuts restraining surfaces and directly over joints in structural floor. Install expansion joints in accordance with TCA "Handbook for Ceramic Tile Installation."

3.5 INSTALLATION

A. Allowable Variations in Finished Work: Do not exceed the following deviations from level and plumb, and from elevations, locations, slopes and alignment shown.

1. Floors: 1/8" in 10'-0" run, any direction; +\-1/8" at any location; 1/32" offset at any location.

2. Joints: +1/32" joint width variation of any location; 1/16" in 3'-0" run deviation from plumb and true.

B. Waterproofing Membrane

1. Install the membrane in strict accordance with manufacturer's written recommendations.

2. Upon completion of work, test horizontal membrane for leaks by plugging the drain or damming areas and filling with water for a period of 48 hours minimum. Inspect for leakage. Make necessary adjustments to stop all leakage and retest until watertight. If membrane is not covered by another surface immediately, provide protection until membrane is covered.

C. Comply with the ANSI standard installation specifications A108.1 and A108.10 and TCA Detail F-121. Provide minimum temperature limits and installation practices as recommended by mortar and grout materials manufacturers.

1. Setting bed shall provide for an average contact area of not less than 95%.

D. Extend tile work into recesses and under equipment and fixtures to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignments.

E. Comply with manufacturer's instructions for the mixing and installation of materials.

F. Neutralize and seal substrates in accordance with the mortar manufacturer's instructions.

G. Lay tile on grid pattern. Align joints when adjoining tiles on floor, base and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Provide uniform joint widths. Adjust to minimize tile cutting.

3.6 CLEANING AND PROTECTION OF QUARRY TILE

A. Upon completion of placement and grouting, clean all quarry tile surfaces so they are free of foreign matter. Tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Flush surface with clean water before and after cleaning.

B. Apply to all clean completed tile a protective coating of neutral cleaner solution, 1 part cleaner to 1 part water.

C. Leave finished installation clean and free of cracked, chipped, broken, unbonded or otherwise defective tile work.

D. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent damage and wear. Prohibit foot and wheel traffic from tiled floors for at least 3 days after grouting is completed. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 095113

ACOUSTIC PANEL CEILINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the acoustic panel ceilings as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Acoustical panel units.

2. Exposed "T" suspension system, including hangers and inserts.

3. Provisions for the installation of lighting fixtures, diffusers, grilles and similar items provided under other Sections.

4. Cutting, drilling, scribing and fitting as required for electro-mechanical penetrations.

5. Perimeter and column moldings, trim and accessories for acoustical ceilings.

1.3 RELATED SECTIONS

A. Metal deck - Section 053100.

B. Drywall ceilings - Section 092900.

C. Diffusers, grilles and related frames - Division 23.

D. Lighting fixtures - Division 26.

1.4 QUALITY ASSURANCE

A. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations published by the Ceilings and Interior Systems Contractor's Association.

B. Qualifications of Installers

1. The suspended ceiling subcontractor shall have a record of successful installation of similar ceilings acceptable to Commissioner and shall be currently properly trained by the manufacturer of the ceiling suspension system.

2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

C. The work is subject to the following standards:

1. ASTM C 635 "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings," American Society for Testing and Materials.

2. ASTM C 636 "Standard Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels," American Society for Testing and Materials.

D. In addition to suspension system specified, provide seismic struts and seismic clips to meet seismic standards as required by prevailing Codes and Ordinances.

1.5 SUBMITTALS

A. Shop Drawings: Submit completely dimensioned ceiling layouts for all areas where acoustical ceilings are required, showing:

1. Any deviations from Commissioner's reflected ceiling plan layouts, especially lighting fixture and dimensions. Also indicate if any light fixtures will not fit into Commissioner's ceiling layout due to dimensional restrictions of field conditions.

2. Direction and spacing of suspension members and location of hangers for carrying suspension members.

3. Direction, sizes and types of acoustical units, showing suspension grid members, and starting point for each individual ceiling area.

4. Moldings at perimeter of ceiling, at columns and elsewhere as required due to penetrations or exposure at edge of ceiling tiles.

5. Location and direction of lights, air diffusers, air slots, and similar items in the ceiling plane.

6. Details of construction and installation at all conditions.

7. Materials, gauges, thickness and finishes.

B. Samples and Product Literature: Submit the following samples and related manufacturer's descriptive literature.

1. Twelve (12) inch long sample of each components of suspension systems, including moldings.

2. Acoustical units - full size.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Acoustical panel ceilings shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.8 PROJECT CONDITIONS

A. Do not install acoustical ceilings until wet-work in space is completed and nominally dry, work above ceilings has been completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.9 COORDINATION

A. Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire suppression system components, and partition system.

1.10 EXTRA STOCK

A. Extra Stock: Deliver stock of maintenance material to City of New York. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quantity of full size units equal to 2.0% of amount installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

A. CL-02: Provide 7/8" thick, 24" x 24" fiberglass panels, with acoustically transparent membrane, equal to "Optima Open Plan, Vector" No. 3900, as manufactured by Armstrong World Industries, or equal made by Celotex or USG Interiors, Inc. Panels shall have factory applied white finish with light reflectance value of 0.90. Panels shall meet ASTM E 1264, Type XII, Form 2, Pattern E, Class A, with a UL flame spread rating of 0-25.

2.2 SUSPENSION SYSTEM

A. Provide exposed "T" suspension system, steel, with low sheen white baked enamel finish equal to "Prelude," 15/16" exposed tee 2-way grid system made by Armstrong World Industries, or equal made by USG Interiors, Inc. or Chicago Metallic Corp.

B. The suspension system shall support the ceiling assembly shown on the drawings and specified herein, with a maximum deflection of 1/360 of the span, in accordance with ASTM C 635.

C. Provide min. 12 ga. galvanized wire hangers, soft annealed steel conforming to ASTM A 641, prestretched, Class 1 zinc coating, soft temper, size so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire.

D. Hanger for suspension system shall be 1" x 3/16", galvanized steel flats or 1/4" diameter galvanized pencil rods spaced 4'-0" o.c. conforming to New York City Code requirements.

E. Main carrying channels, to which suspension systems shall be fastened, shall be 1-1/2" cold rolled galvanized steel channel; spaced 4'-0" o.c., conforming to New York City Code requirements.

F. Provide ceiling clips and inserts to receive hangers, type as recommended by suspension system manufacturer, sizes for pull-out resistance of not less than five (5) times the hanger design load, as indicated in ASTM C 635.

G. Suspension systems shall conform to ASTM C 635, intermediate duty.

H. Provide manufacturer's standard wall moldings with off-white baked enamel finish to match suspension systems. For circular penetrations of ceilings, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas where acoustic panel ceilings are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected to permit proper installation of the layout.

3.2 PREPARATION

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans.

3.3 INSTALLATION

A. Codes and Standards: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations and industry standards.

B. Install suspension systems to comply with ASTM C 636, with wire hangers supported only from building structural members. Locate hangers not more than 6" from each end and spaced 4'-0" along direct-hung runner, leveling to tolerance of 1/8" in 12'-0".

C. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices which are secure and appropriate for substrate, and which will not deteriorate or fail with age or elevated temperatures.

D. Space rod or flat iron (New York City) hangers not more than 4'-0" o.c. along main carrying channels; attach by clips or wire ties to building structure. Locate hangers not more than 6" from each end. Space main carrying channels 4'-0" o.c. Attach suspension system to carrying channels using clips or ties, leveling to a tolerance of 1/8" in 12'-0".

E. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, reinforcing, countersplaying or other equally effective means.

F. Install edge moldings at edges of each acoustical ceiling area, and at locations where edge of acoustical units would otherwise be exposed after completion of the work.

1. Secure moldings to building construction by fastening through vertical leg. Space holes not more than 3" from each end and not more than sixteen (16) inches o.c. between end holes. Fasten tight against vertical surfaces.

2. Level moldings with ceiling suspension system, to a level tolerance of 1/8" in 12'-0".

G. Install acoustical units in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

H. Install hold-down clips in toilet areas, and in areas where required by governing regulations; space 2'-0" o.c. on all cross tees.

I. Light fixtures or other ceiling apparatus shall not be supported from main beams or cross tees if their weight causes the total load to exceed the deflection capability of the ceiling suspension system. In such cases the load shall be supported by supplemental hangers furnished and installed by this Section of work.

J. Where fixture or ceiling apparatus installation causes eccentric loading on runners, provide stabilizer bars to prevent rotation.

3.4 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings, including trim, edge molding, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 095133

METAL CEILINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the metal ceilings as shown on the drawings and/or specified herein, including but not limited to, the following:

1. Metal ceilings

2. Suspension system, including hangers and inserts.

3. Provisions for the installation of lighting fixtures, diffusers, grilles and similar items provided under other Sections.

4. Cutting, drilling, scribing and fitting as required, including for all electro/mechanical penetrations.

5. Perimeter and column moldings, trim and accessories for acoustical ceilings.

1.3 RELATED SECTIONS

A. Steel deck - Section 053100.

B. Diffusers, grilles and related frames - Division 23.

C. Lighting - Division 26.

1.4 QUALITY ASSURANCE

A. Qualifications of Installers

1. The suspended ceiling subcontractor shall have a record of successful installations of similar ceilings acceptable to the Commissioner and shall be currently properly trained by the manufacturer of the ceiling suspension system.

2. For the actual fabrication and installation of all components of the system, use only personnel who are thoroughly trained and experienced in the skills required and completely familiar with the requirements established for this work.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations published by the Ceilings and Interior Systems Contractors' Association.

C. The work is subject to applicable portions of the following standards:

1. ASTM C 635 "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings," American Society for Testing and Materials.

2. ASTM C 636 "Standard Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels," American Society for Testing and Materials.

1.5 SUBMITTALS

A. Shop Drawings: Submit completely dimensioned ceiling layouts for all areas where metal linear ceilings are required, showing:

1. Any deviations from reflected ceiling plan layouts, especially lighting fixture and dimensions. Also indicate if any light fixtures will not fit into ceiling layout due to dimensional restrictions of field conditions.

2. Direction and spacing of suspension members and location of hangers for carrying suspension members.

3. Direction, sizes and types of metal units, showing suspension grid members, and starting point for each individual ceiling area.

4. Moldings at perimeter of ceiling, at columns and elsewhere as required due to penetrations or exposure at edge of ceiling tiles.

5. Location and direction of lights, air diffusers, air slots, and similar items in the ceiling plane.

6. Details of construction and installation at all conditions.

7. Materials, gauges, thickness and finishes.

B. Samples: Submit samples, including manufacturer's descriptive literature for:

1. All components of suspension systems, including mouldings.

2. Metal tile - full size.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Handle metal acoustical ceiling units carefully to avoid damaging units in any way.

1.7 PROJECT CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, fire suppression system components, and partition system.

PART 2 PRODUCTS

2.1 CL-03 METAL CEILING PANELS

A. Provide 24" x 24" x 0.040" thick aluminum panels, "Metalworks Torsion Spring" with RD1522 perforation, by Armstrong, or equivalent of Hunter Douglas, Ceilings Plus, or approved equal; color "Gun Metal (MYA)."

2.2 SUSPENSION SYSTEM

A. Provide manufacturer's torsion spring system.

B. Hanger for suspension system shall be 1" x 3/16", galvanized steel flats or 1/4" diameter galvanized pencil rods spaced 4'-0" o.c., unless greater required by Code.

C. Main carrying channels, to which suspension systems shall be fastened, shall be 1-1/2" cold rolled galvanized steel channel; spaced 4'-0" o.c., unless greater required by Code.

D. Suspension system shall conform to ASTM C 635, intermediate duty, with deflection limited to 1/360 of span.

E. For circular penetrations of ceilings, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas where metal acoustic ceilings are to be installed and correct any of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.

B. Measure each ceiling area and establish layout of metal acoustic units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans.

3.3 INSTALLATION

A. Codes and Standards: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations and industry standards.

B. Install suspension systems to comply with ASTM C 636, as applicable, with hangers supported only from building structural members. Locate hangers not less than 6" from each end, leveling to tolerance of 1/8" in 12'-0".

C. Space rod or flat iron hangers not more than 4'-0" o.c. along main carrying channels; attach by clips or wire ties to building structure. Locate hangers not more than 6" from each end. Space main carrying channels 4'-0" o.c. Attach suspension system to carrying channels using clips or ties, leveling to a tolerance of 1/8" in 12'-0". Provide supplemental framing to comply with wind uplift requirements and calculations.

D. Install edge moldings at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.

1. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.

E. Scribe and cut metal acoustical units for accurate fit at borders and at interruptions and penetrations by other work through the ceilings. Stiffen edges of cut units as required to eliminate evidence of oil-canning or buckling.

F. Light fixtures or other ceiling apparatus shall not be supported from main beams or cross tees if their weight causes the total load to exceed the deflection capability of the ceiling suspension system. In such cases the load shall be supported by supplementary hangers furnished and installed by this Section of work.

3.4 CLEANING AND PROTECTION

A. Clean exposed surfaces of metal acoustical units, and of trim, edge moldings and suspension members; comply with manufacturers' instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION

SECTION 096813

CARPET TILE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor materials, equipment and services necessary to complete the carpet tile as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Carpet tile.

2. Adhesive.

1.3 RELATED SECTIONS

A. Concrete sub-floor - Section 033000.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Firm with not less than three (3) years' experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this Section.

B. General Terminology/ Information Standard: Refer to current edition of "Carpet Specifier's Handbook" by The Carpet and Rug Institute; for definitions of terminology not otherwise defined herein, and for general recommendations and information.

C. Carpet used on Project must be from same dye lot for each carpet type.

D. Carpet Fire-Test-Response Characteristics: Provide carpet with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify carpet with appropriate markings of applicable testing and inspecting agency.

1. Surface Flammability: Passes CPSC 16 CFR, Part 1630.

2. Flame Spread: 25 or less per ASTM E 84.

3. Smoke Developed: 450 or less per ASTM E 84.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's complete technical product data for each type of carpet, cushion and accessory item required.

B. Samples: Submit full size samples of carpet tile and six (6) inches long samples of each type exposed edge stripping.

C. Certification: Submit manufacturer's certification stating that carpet materials furnished comply with specified requirements.

1. Include listing of mill register numbers for carpet furnished.

2. Include supporting certified laboratory test data indicating that carpet meets or exceeds specified test requirements.

D. Maintenance Data: Submit manufacturer's printed maintenance recommendations, including methods and frequency recommended for maintaining carpet in optimum conditions under anticipated traffic and use conditions.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Carpet tile shall contain a minimum of 25% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.7 EXTRA STOCK

A. Produce and deliver to project at least five (5) percent overrun on calculated yardage. Provide required overrun exclusive of carpet needed for proper installation, waste and usable scraps.

1.8 DELIVERY, STORAGE AND HANDLING

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 5: "Storage and Handling."

B. Deliver materials to Project site in original factory wrappings and containers, labeled with identification of manufacturer, brand name, and lot number.

C. Store materials on-site in original undamaged packages, inside well-ventilated area protected from weather, moisture, soilage, extreme temperatures, and humidity. Lay flat, with continuous blocking off ground.

1.9 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 6: "Site Conditions."

B. Space Enclosure and Environmental Limitations: Do not install carpet until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.

C. Subfloor Moisture Conditions: Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours (14.6 kg/1000 sq. m/24 hours) when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1, with subfloor temperatures not less than 55 deg F (12.7 deg C).

D. Subfloor Alkalinity Conditions: A pH range of 5 to 9 when subfloor is wetted with potable water and pHydrion paper is applied.

1.10 WARRANTY

A. Special Carpet Warranty: Submit a written warranty executed by carpet manufacturer agreeing to repair or replace carpet that does not meet requirements or that fails in materials or workmanship within the specified warranty period. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Milliken

B. Interface

C. Shaw Industries, Dalton, GA.

D. Mohawk Commercial Carpet, Kennesaw, GA.

E. Or approved equal.

2.2 CARPET TILE

A. CP-01: Milliken 125 Self Adhering Loop Pile Modular Carpet Tile.

2.3 ACCESSORIES

A. Concrete-Slab Primer: Nonstaining type as recommended by the Carpet manufacturer.

B. Adhesive for Carpet Tile: Provide release type adhesive as recommended by the carpet tile manufacturer for use with carpet tile specified. Provide adhesive which complies with flame spread rating required for the carpet installation.

C. Miscellaneous Materials: Provide the types of adhesives and tape, and other accessory items recommended by the carpet manufacturer and Installer for the conditions of installation and use.

D. Leveling Compound: Latex/Portland cement flash patching and leveling compound equal to No. DSP-520 made by H.B. Fuller or No. 226 with 3701 admixture made by Laticrete or equal made by Mapei, or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where carpet tile is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not

proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PRE-INSTALLATION REQUIREMENTS

A. General: Comply with carpet manufacturer's installation recommendations to prepare substrates indicated to receive carpet installation.

B. Floor shall be clean and free of cracks and protrusions. Any gaps or cracks more than 1/16" wide to be filled in with latex leveling compound. Protrusions must be sanded down smooth, the floor cleanly swept and vacuumed if necessary to remove all dust and grit.

C. Floor temperature shall be 65 deg., at least 24 hrs. prior to installation; and 48 hrs. after carpet is installed.

D. Conduct a moisture test. The presence of moisture in the concrete floor will interfere with the curing and subsequent performance of the adhesive. Conduct the test as follows:

1. Drive a concrete nail a half inch into the floor. Then remove the nail.

2. Place a small amount of anhydrous calcium chloride or calcium sulphate crystals over the hole.

3. Cover the crystals and the hole with a piece of flat glass and seal the edges with waterproof tape or putty. Since concrete pourings vary, repeat the test every 1500 sq. ft.

4. Leave in place 72 hrs. Any color change in the crystals indicates the presence of moisture. Do not apply carpet until slab is free of moisture and meets with approval of carpet adhesive manufacturer.

E. Concrete-Subfloor Preparation: Apply concrete-slab primer, according to manufacturer's directions, where recommended by the Carpet manufacturer.

F. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.3 INSTALLATION

A. General

1. Comply with manufacturer's instructions and recommendations. Maintain direction of pattern and texture, including lay of pile.

2. Adhere all tiles with a full spread of adhesive. Dry-fit cut tiles and apply adhesive to tile back after tile has been cut.

3. Tiles shall be installed in a monolithic corner to corner manner following arrows printed on back of each tile indicating pile direction. Tiles shall be installed to achieve patterns as directed by the Commissioner.

4. Vinyl reducer strips shall be used along any necessary open edges so as to maintain the fixed perimeter.

3.4 CLEANING UP

A. Upon completion of the carpeting installation in each area, visually inspect all carpet installed in that area and immediately remove all dirt, soil, and foreign substance from the exposed face; inspect all adjacent surfaces and remove all marks and stains caused by the carpet installation: remove all packaging materials, carpet scraps, and other debris from the carpet installation to the area of the job site set aside for its storage.

3.5 PROTECTION

A. General: Comply with CRI 104, Section 15: "Protection of Indoor Installation."

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure carpet is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 099000

PAINTING AND FINISHING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Prime painting unprimed surfaces to be painted under this Section.
2. Painting all items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
3. High performance coating on AESS and trim.
4. Painting all ferrous metal (except stainless steel) exposed to view.
5. Painting all galvanized ferrous metals exposed to view.
6. Painting interior concrete block exposed to view.
7. Painting gypsum drywall exposed to view.
8. Painting plaster surfaces.
9. Clear finish for interior wood base.
10. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
11. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers, lighting fixtures, and the like, which are exposed to view through these items.
12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
13. Painting of any surface not specifically mentioned to be painted herein or on drawings, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, shall be included as though specified.

1.3 RELATED SECTIONS

A. Shop priming is required on some, but not all of the items scheduled to be field painted. Refer to other Sections of work for complete description.

B. Architectural Exposed Structural Steel (AESS) – Section 051213

C. Shop Coat on Machinery and Equipment: Refer to the Sections under which various items of manufactured equipment with factory applied shop prime coats are furnished, including, but not necessarily limited to, the following Sections. All items of equipment furnished with prime coat finish shall be finish painted under this Section.

1. Plumbing - Division 22.

2. Heating, ventilation and air conditioning – Division 23.

D. Color Coding of Mechanical Piping and Electrical Conduits – Divisions 22 and 26.

1. This Color Coding consists of an adhesive tape system and is in addition to painting of piping and conduits under this Section, as specified above.

1.4 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Items of equipment furnished with complete factory finish, except for items specified to be given a finish coat under this Section.

B. Factory-finished toilet partitions.

C. Factory-finished acoustical tile.

D. Non-ferrous metals, except for items specified and/or indicated to be painted.

E. Finished hardware, excepting hardware that is factory primed.

F. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials resulting from the work of this Section.

1.5 REFERENCES

A. General: Comply with the applicable provisions of the referenced standards except as modified by governing codes and the Contract Documents. Where a recommendation or suggestion occurs in the referenced standards, such recommendation or suggestion shall be considered mandatory. In the event of conflict between referenced standards, this specification or within themselves, the more stringent standard or requirement shall govern.

1. The Society for Protective Coatings (SSPC)

a. SSPC Volume 1 "Good Painting Practice."
b. SSPC Volume 2 "Systems and Specifications."

2. The Painting and Decorating Subcontractors of America (PDCA): PDCA "Specification Manual."

3. American Society for Testing and Materials (ASTM):

   a. ASTM D 16 "Standard Terminology for Paint, Related Coatings, Materials, and Applications."
   b. ASTM D 4261 "Practice for Surface Cleaning Unit Masonry for Coating."

4. United States Green Building Council (USGBC): Leadership in Energy & Environmental Design (LEED): Green Building Rating System for New Construction & Major Renovations (NC) Version 2.2.

1.6 QUALITY ASSURANCE

A. Reference Standards

1. The Society for Protective Coatings (SSPC) levels as required by paint system including but not limited to:

   A. SSPC-SP3, Power Tool Cleaning

   B. SSPC-SP 6/NACE No.3, Commercial Blast Cleaning

B. Job Mock-Ups

1. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the Commissioner. Paint mock-ups to include door and frame assembly.

2. These applications when approved will establish the quality and workmanship for the work of this Section.

3. Repaint individual areas which are not approved, as determined by the Commissioner, until approval is received. Assume at least two paint mock-ups of each color and gloss for approval.

4. Mockups for Commissioner Approval and for evaluation of installed work:

   A. PE-01 - Coraflon ADS PPG Silver Shadow on 1/8" x 12" x 12" Steel Plate.

   B. PE-01 - Coraflon ADS PPG Silver Shadow on 24" Long Tapered Beam Section from Tee Box Frame.

   C. PE-01 - Coraflon ADS PPG Silver Shadow on Interior Tapered Column Base Plate Connection Node.

C. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces.

D. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of

the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Commissioner in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.7 SUBMITTALS

A. Materials List

1. Before any paint materials are delivered to the job site, submit to the Commissioner a complete list of all materials proposed to be furnished and installed under this portion of the work.

2. This shall in no way be construed as permitting substitution of materials for those specified or accepted for this work by the Commissioner.

B. Samples

1. Accompanying the materials list, submit to the Commissioner copies of the full range of colors available in each of the proposed products.

2. Prepare and deliver to the Commissioner two (2) identical sets of Samples of each of the selected colors and glosses painted onto 8-1/2" x 11" x 1/8" thick material; whenever possible, the material for Samples shall be the same material as that on which the coatings will be applied in the work.

C. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these specifications, submit for the Commissioner's review the current recommended method of application published by the manufacturer of the proposed material.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product

listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.8 LEED PERFORMANCE REQUIREMENTS

A. The following criteria are required for the products included in this section:

1. Adhesives, sealants, paints, and coatings used for work in this section shall meet the requirements of the "Low-Emitting Indoor Materials" section. Certification of these products shall be in accordance with the Submittal Requirements below.

2. Paints and coatings manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements below.

3. Interior Top Coats shall meet the following:

   a. Scrubability (Abrasion Resistance) The product shall demonstrate at least 100 cycles (200 separate strokes) before failure, as determined by American Society for Testing and Materials (ASTM) D2486, Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
   b. Hiding Power (Opacity): The product shall demonstrate a minimum of 0.95 contrast ration at 400 square feet per gallon as determined by ASTM D2805, Standard Test Method for Hiding Power of Paints by Reflectometry. Compliance will be determined by testing white paint having a minimum 80% reflectance.
   c. Washability (Stain removal): The product shall demonstrate the following minimum requirements for stain removal as determined by ASTM 4828 Mechanical Method, Standard Test Method for Practical Washability of Organic Coating.
   d. Flat: 5 minimum rating
   e. Non-Flat: 7 minimum rating.

4. Exterior Topcoats: Products intended for exterior opaque topcoat shall meet the following requirements:

   a. Hiding Power (Opacity): The product shall demonstrate a minimum of 095 contrast ration at 400 square feet per gallon as determined by ASTM D2805, Standard Test Method for Hiding Power of Paints by Reflectometry,

Compliance will be determined by testing a white paint having a minimum 80% reflectance.

5. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

   a. Flat Paints and Coatings: VOC content of not more than 50 g/L.
   b. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
   c. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

6. Restricted Components: Paints and coatings shall not contain any of the following:

   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1,2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.
   m. Ethylbenzene.
   n. Formaldehyde.
   o. Hexavalent chromium.
   p. Isophorone.
   q. Lead.
   r. Mercury.
   s. Methyl ethyl ketone.
   t. Methyl isobutyl ketone.
   u. Methylene chloride.
   v. Naphthalene.
   w. Toluene (methylbenzene).
   x. 1,1,1-trichloroethane.
   y. Vinyl chloride.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

1.9 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use.

B. Protection

1. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.

2. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste.

3. Use all means necessary to protect paint materials before, during and after application and to protect the installed work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.10 EXTRA STOCK

A. Upon completion of this portion of the Work, deliver to the City of New York an extra stock of paint equaling approximately ten (10) percent of each color and gloss used and each coating material used, with all such extra stock tightly sealed in clearly labeled containers.

1.11 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F. and 90 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 45 degrees F. and 95 degrees F. unless otherwise permitted by the paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds eighty-five (85) percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

D. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.

B. Colors and Glosses: All colors and glosses shall be as selected by the Commissioner. Certain colors will require paint manufacturer to prepare special factory mixes to match

colors selected by the Commissioner. Color schedule (with gloss) shall be furnished by the Commissioner.

C. Coloring Pigment: Products of or furnished by the manufacturer of the paint or enamel approved for the work.

D. Linseed Oil: Raw or boiled, as required, of approved manufacture, per ASTM D 234 and D 260, respectively.

E. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D 13.

F. Shellac: Pure gum shellac (white or orange) cut in pure denatured alcohol using not less than four (4) lbs. of gum per gallon of alcohol.

G. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacture.

H. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

2.2 GENERAL STANDARDS

A. The various surfaces shall be painted or finished as specified below in Article 2.4. However, the Commissioner reserves the right to change the finishes within the range of flat, semi-gloss or gloss, without additional cost to the City of New York.

B. All paints, varnishes, enamels, lacquers, stains and similar materials must be delivered in the original containers with the seals unbroken and label intact and with the manufacturer's instructions printed thereon.

C. All painting materials shall bear identifying labels on the containers with the manufacturer's instructions printed thereon.

D. Paint shall not be badly settled, caked or thickened in the container, shall be readily dispersed with a paddle to a smooth consistency and shall have excellent application properties.

E. Paint shall arrive on the job color-mixed except for tinting of under-coats and possible thinning.

F. All thinning and tinting materials shall be as recommended by the manufacturer for the particular material thinned or tinted.

G. It shall be the responsibility of the Contractor to see that all mixed colors match the color selection made by the Commissioner prior to application of the coating.

2.3 HIGH PERFORMANCE COATING PRODUCTS

A. High Performance Coatings, General

1. Material Compatibility:

a. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and

application as demonstrated by manufacturer, based on testing and field experience.

b. Provide products of same manufacturer for each coat in a coating system.

2. Colors: PE-01 - Coraflon ADS PPG Silver Shadow, or approved equal.

B. High Performance Coatings - Metal Primers

1. Epoxy Primer

a. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Architectural Finishes, Inc.; Pitt-Guard DTR Epoxy Mastic Coating 97-145 Series, or approved equal.

C. High Performance Coatings - Metal Primers for Field-Applied Fluoropolymer Finish Systems

1. High Build Epoxy Primer/Intermediate:

a. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Architectural Finishes, Inc.; Coraflon ADS Zinc Rich Epoxy Primer ADS570A/570B/ADS570Z and Coraflon ADS Epoxy Intermediate Coat ADS538 + Curing Agent Component ADS539, or approved equal.

D. High Performance Coatings - Polyurethane Coatings

1. Two-Component, Aliphatic Polyurethane,

a. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Architectural Finishes, Inc.; Pitthane, Polyurethane Aliphatic 2 Comp. Clear, 95-8800 - 60 degree sheen, or approved equal.

2. Two -Component, Low VOC Satin Acrylic Polyurethane BRP1000 - 30 degree sheen, or approved equal.

E. High Performance Coatings - Fluoropolymer High Performance Architectural Coatings

1. Fluoropolymer, Field-Applied, Two-Component, Pigmented (Gloss Level as specified):

a. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Architectural Finishes, Inc.; Coraflon ADS -30 degree sheen, or approved equal.

2. Fluoropolymer, Field-Applied, Two-Component, Unpigmented (Gloss Level as specified) (provided topcoat contains metallic pigmentation):

a. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Architectural Finishes, Inc.; Coraflon ADS, or approved equal.

2.4 SCHEDULE OF FINISHES (EXTERIOR)

A. High Performance Coating on Exterior AESS and Trim

1. Shop-Applied Fluoropolymer Coating System

a. Prime Coat: Coraflon ADS Inorganic Zinc ADS 570 ABZ @ 3.0-4.0 Mils DFT, or approved equal.
b. Intermediate Coat: Apply one coat of Coraflon ADS Epoxy Primer/ Intermediate ADS573/ADS574, or approved equal, @ 3.0-5.0 Mils DFT.
c. Topcoat: Apply one coat of Coraflon ADS Metallic, or approved equal, @ 1.5 to 2.0 DFT per instructions on the *technical data bulletin*.
d. Apply one coat of Coraflon ADS Clear, or approved equal. ADS Metallic coatings require a clear finish coat. The clear coat protects the aluminum pigmentation from the ultra-violet degradation. Allow metallic topcoat to dry 4 hours minimum before top coating.
e. Final cure will be achieved in three to five days.

B. High Performance Coating On Exterior Galvanized Ferrous Metals

First Coat: "27 Typoxy" or "N69 Epoxoline II" by Tnemec; "Intergard 345" by International Protective Coatings; "Carboguard 893 SG" or "Carboguard 888" by Carboline; "Devran 203 WB Epoxy Primer" by Akzo; Epoxy Mastic Coating V 160 Series by Cortech/Moore or "Recoatable Epoxy Primer 867-45" by Sherwin Williams, or approved equal.

Second Coat: "V73 Endura Shield" or "1074/1075" by Tnemec; "Interthane 870UHS" or "990 UHS" by International Protective Coatings; "Carbothane 133 LH" by Carboline; "Devthane 379UH Aliphatic Vizethne" by Akzo; Acrylic Aliphatic Urethane V 500 (Gloss) or V 510 (Semi-Gloss) by Corotech/Moore or "Hi-Solids Urethane B65-300/350" by Sherwin Williams, or approved equal.

C. High Performance Coating On Exterior Non-Galvanized Ferrous Metals

Prime Coat: "Tneme-Zinc 90/97" by Tnemec; "Interzinc 52" or "315" by International Protective Coatings; "Carbozinc 859, Class B" by Carboline; "Cathacoat 302V Reinforced Inorganic Zinc Primer" by Akzo; Organic Zinc Rich Primer V 170 by Corotech/Moore or "Zinc Clad II Plus Inorganic Zinc Rich Coating B69V212" by Sherwin Williams, or approved equal.

Second Coat: "27 Typoxy" or "N69 Epoxoline II" by Tnemec; "Intergard 345" by International Protective Coatings; "Carboguard 893 SG" or "Carboguard 888" by Carboline; "Bar-Rust 231V Multi Purpose Epoxy Mastic" by Akzo; Epoxy Mastic Coating V 160 Series by Corotech/Moore or "Macropoxy 646 I.C. Epoxy B58-600" by Sherwin Williams, or approved equal.

Third Coat: "V73 Endura Shield" or "1074/1075" by Tnemec; "Interthane 870UHS" or "990 UHS" by International Protective Coatings; "Carbothane 133 LH" by Carboline; "Devthane 379 UH Aliphatic Urethane" by Akzo; Acrylic Aliphatic Urethane V 500 (Gloss) or V 510 (Semi-Gloss) by

Corotech/Moore or "Hi-Solids Polyurethane B65-300/350" by Sherwin Williams, or approved equal.

2.5 SCHEDULE OF FINISHES (INTERIOR)

A. Manufacturers: Except as otherwise noted, provide the painting products listed for all required interior painting made by one of the manufacturers listed in the paint schedule (Section 2.4), or an approved equal. These companies are Benjamin Moore, Akzo Nobel Paint (Glidden Professional), and Sherwin Williams (S-W). Comply with number of coats and required minimum mil thicknesses as specified herein.

B. Interior Ferrous Metal

Satin Finish/Latex

Primer: 1 coat Moore Alkyd Metal Primer (Z06)
1 coat Akzo Devflex 4020 PF DTM Prime/Flat Finish or touch-up shop primer
1 coat Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer B66-310

First Coat: 1 coat Moore Super Spec-HP DTM Acrylic Low Luster P25
1 coat Akzo: Glidden Professional Diamond 350 Acrylic Eggshell GP1403
1 coat S-W Pro-Classic Waterborne Acrylic Satin, B20

Second Coat: 1 coat Moore Super Spec-HP DTM Acrylic Low Luster P25
1 coat Akzo: Glidden Professional Diamond 350 Acrylic Eggshell GP1403
1 coat S-W Pro-Classic Waterborne Acrylic Satin, B20
a. Total DFT not less than: 3.9 mils

Semi-Gloss Finish/Latex

Primer: 1 coat Moore Super Spec-HP Acrylic Metal Primer (P04)
1 coat Akzo Devflex 4020 PF DTM Primer/Flat Finish or touch-up shop primer.
1 coat Sherwin-Williams, Pro Industrial Pro-Cryl Universal Primer B66-310

First Coat: 1 coat Moore Super Spec HP DTM Acrylic Semi-Gloss (P29)
1 coat Akzo: Glidden Professional Diamond 350 Acrylic S/G 6P1407
1 coat S-W Pro-Classic Waterborne Acrylic Semi-Gloss, B31

Second Coat: 1 coat Moore Super Spec HP DTM Acrylic Semi-Gloss (P29)
1 coat Akzo: Glidden Professional Diamond 350 Acrylic S/G 6P1407
1 coat S-W Pro-Classic Waterborne Acrylic Semi-Gloss, B31
a. Total DFT not less than: 4.0 mils

C. Interior Concrete Block

Flat Finish/Vinyl Acrylic Latex over Filler

Block Filler: 1 coat Moore Super Spec Masonry Int./Ext. High Build Block Filler (206)
1 coat Akzo Glidden Professional Concrete Coatings Block Filler GP 3010-1200
1 coat S-W Preprite Block Filler, B25W25

First Coat: 1 coat Moore Ultra Spec 500 Interior Flat Latex (N536)
1 coat Akzo Glidden Professional Diamond 350 Flat GP 1201
1 coat S-W Promar 200 Zero VOC Interior Latex Flat, B30-2600
Second Coat: 1 coat Moore Ultra Spec 500 Interior Flat Latex (N536)
1 coat Akzo Glidden Professional Diamond 350 Flat GP 1201
1 coat S-W Promar 200 Zero VOC Interior Latex Flat, B30-2600
a. Total DFT not less than: 10.7 mils

Eggshell Finish/Vinyl Acrylic Latex Over Filler
Block Filler: 1 coat Moore Super Spec Masonry Int./Ext. High Build Block Filler (206)
1 coat Akzo Glidden Professional Concrete Coatings Block Filler GP 3010-1200
1 coat S-W Preprite Block Filler, B25W25
First Coat: 1 coat Moore Ultra Spec 500 Interior Latex Eggshell (N538)
1 coat Akzo Glidden Professional Diamond 350 Acrylic Eggshell 6P1403
1 coat S-W Promar 200 Zero VOC Interior Latex Eggshell, B20-2600
Second Coat: 1 coat Moore Ultra Spec 500 Interior Latex Eggshell (N538)
1 coat Akzo Glidden Professional Diamond 350 Acrylic Eggshell 6P1403
1 coat S-W Promar 200 Zero VOC Interior Latex Eggshell, B30-2600
a. Total DFT not less than: 10.9 mils

Semi-Gloss Finish/Vinyl Acrylic Latex over Filler
Block Filler: 1 coat Moore Super Spec Masonry Int./Ext. High Build Block Filler (206)
1 coat Akzo Glidden Professional Concrete Coatings Block Filler GP 3010-1200
1 coat S-W Preprite Block Filler, B25W25
First Coat: 1 coat Moore Ultra Spec 500 Interior Latex Gloss (N540)
1 coat Akzo Glidden Professional Diamond 350 Acrylic S/G GP 1407
1 coat S-W Promar 200 Zero VOC Interior Latex S. Gloss, B31-2600
Second Coat: 1 coat Moore Ultra Spec 500 Interior Latex Gloss (N540)
1 coat Akzo Glidden Professional Diamond 350 Acrylic S/G GP 1407
1 coat S-W Promar 200 Zero VOC Interior Latex S. Gloss, B31-2600
a. Total DFT not less than: 10.7 mils

D. Interior Drywall, Plaster and Cement Board

Flat Finish/Vinyl Acrylic Latex
Primer: 1 coat Moore Ultra Spec 500 Interior Latex Primer (N534)
1 coat Akzo Glidden Professional Gripper GP 3210
1 coat S-W Promar 200 Interior Latex Primer
First Coat: 1 coat Moore Ultra Spec 500 Latex Flat (N536)
1 coat Akzo Glidden Professional Diamond 350 Flat GP 1201
1 coat S-W Promar 200 "O" VOC Interior Latex Flat, B30-2600
Second Coat: 1 coat Moore Ultra Spec 500 Latex Flat (N536)
1 coat Akzo Glidden Professional Diamond 350 Flat GP 1201
1 coat S-W Promar 200 "O" VOC Interior Latex Flat, B30-2600

a. Total DFT not less than: 3.6 mils

Eggshell Finish/Vinyl Acrylic Latex

Primer: 1 coat Moore Ultra Spec 500 Interior Latex Primer (N534)
1 coat Akzo Glidden Professional Gripper GP 3210
1 coat S-W Promar 200 Interior Latex Primer,

First Coat: 1 coat Moore Ultra Spec 500 Interior Latex Eggshell (N538)
1 coat Akzo Glidden Professional Diamond 350 Acrylic Eggshell GP 1403
1 coat S-W Promar 200 "O" VOC Interior Latex Egg-Shell, B20-2600

Second Coat: 1 coat Moore Ultra Spec 500 Interior Latex Eggshell (N538)
1 coat Akzo Glidden Professional Diamond 350 Acrylic Eggshell GP 1403
1 coat S-W Promar 200 "O" VOC Interior Latex Egg-Shell B20-2600
a. Total DFT not less than: 3.8 mils

E. Clear Finish for Interior Wood Base

1. Transparent Finish

a. AWI Factory Finish System "Conversion Varnish, System 5, Transparent."
b. AWI Premium Grade.
c. Stain: As selected by the Architect.
d. Degree of Sheen: Dull satin.
e. Filled or Unfilled Finish.

2.6 EXISTING SURFACES TO BE PAINTED

A. Existing surfaces shall be painted in accordance with schedules given herein except that first or prime coat may be eliminated where existing paint is sound. Where existing paint must be removed down to base material, provide first or prime coat as specified.

2.7 PIPING AND MECHANICAL EQUIPMENT EXPOSED TO VIEW

A. Paint all exposed piping, conduits, ductwork and mechanical and electrical equipment. Use heat resisting paint when applied to heating lines and equipment. The Contractor is cautioned not to paint or otherwise disturb moving parts in the mechanical systems. Mask or otherwise protect all parts as required to prevent damage.

B. Exposed Uncovered Ductwork, Piping, Hangers and Equipment: Latex Enamel Undercoater and one (1) coat Acrylic Latex Flat.

C. Exposed Covered Piping, Duct Work and Equipment: Primer/Sealer and one (1) coat Acrylic Latex Flat.

D. Panel Boards, Grilles and Exposed Surfaces of Electrical Equipment: Latex Enamel Undercoater and two (2) coats Latex Semi-Gloss.

E. Equipment or Apparatus with Factory-Applied Paint: Refinish any damaged surfaces to match original finish. Do not paint over name plates and labels.

F. All surfaces of insulation and all other work to be painted shall be wiped or washed clean before any painting is started.

G. All conduit, boxes, distribution boxes, light and power panels, hangers, clamps, etc., are included where painting is required.

H. All items of Mechanical and Electrical trades which are furnished painted under their respective Contracts shall be carefully coordinated with the work of this Section so as to leave no doubt as to what items are scheduled to be painted under this Section.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 GENERAL WORKMANSHIP REQUIREMENTS

A. Only skilled mechanics shall be employed. Application may be by brush, roller, or spray. Coating method used is contingent upon acceptance of submitted draw down samples and mockups by the Commissioner.

B. The Contractor shall furnish the Commissioner a schedule showing when he expects to have completed the respective coats of paint for the various areas and surfaces. This schedule shall be kept current as the job progresses.

C. The Contractor shall protect his work at all times, and shall protect all adjacent work and materials by suitable covering or other method during progress of his work. Upon completion of the work, he shall remove all paint and varnish spots from floors, glass and other surfaces. He shall remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and shall leave his part of the work in clean, orderly and acceptable condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide ample in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the City of New York.

H. All coats shall be dry to manufacturer's recommendations before applying succeeding coats.

I. All suction spots or "hot spots" in plaster after the application of the first coat shall be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.3 PREPARATION OF SURFACES

A. Existing Surfaces: Clean existing surfaces requiring paint or finishing, remove all loose and flaking paint or finish and sand surface smooth as required to receive new paint or finish. No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, Contractor shall be required to sand smooth and re-finish until surface meets with Commissioner's approval.

B. General

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished shall be perfectly dry, clean and smooth.

2. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

C. Metal Surfaces

1. Weld Fluxes: Remove weld fluxes, splatters, and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.

2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces, where solder flux has been used, with benzene. Clean surfaces by flushing with mineral spirits. For aluminum surfaces, wipe down with an oil free solvent prior to application of any pre-treatment.

a. Bare metal to receive high performance coating specified herein must be blast cleaned SSPC SP-6 prior to application if field applied primer; coordinate with steel trades furnishing ferrous metals to receive this coating to insure that this cleaning method is followed.

3. Shop Primed Metal: Clean off foreign matter as specified for "Bare Metal." Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.

4. Galvanized Metal: Prepare surface as per the requirements of ASTM D 6386.

5. Metal Filler: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with an approved metal filler suitable for the purpose and meeting the requirements of the related Section of work; after setting, sand to a smooth, hard finish, flush with adjoining surface.

D. Plaster Surfaces: Scrape off all plaster nibs or other projections and sand smooth or finish to match adjoining surface texture. Cut out all scratches, cracks, holes, depressions and similar voids and fill with non-shrinking grout, spackles, patching plaster or other approved patching material; allow to dry, refill if necessary, then sand smooth (or refinish) to provide a flush, smooth surface of the same texture as the adjacent plaster surface.

1. Allow at least 28 days, from installation of final plaster coat, before starting work.

E. Gypsum Drywall Surfaces: Scrape off all projections and splatters, spackles all holes or depressions, including taped and spackled joints, sand smooth. Conform to standards established in Section 092900, "Gypsum Drywall."

F. Wood Surfaces: Sand to remove all roughness, loose edges, slivers, or splinters and then brush to remove dust. Wash off grease or dirt with an approved cleaner. Fill all cracks, splits, nail holes, screw holes, and surface defects with putty after the priming coat has been applied. Putty shall be brought up flush with the surface and sanded smooth and touched-up with primer when dry.

G. Block Masonry Surfaces: Thoroughly clean off all grit, grease, dirt mortar drippings or splatters, and other foreign matter. Remove nibs or projections from masonry surfaces. Fill cracks, holes or voids, not filled under the "Masonry" Section, with Portland cement grout, and bag surface so that it has approximately the same texture as the adjacent masonry surface.

H. Testing for Moisture Content: Contractor shall test all plaster, masonry, and drywall surfaces for moisture content using a reliable electronic moisture meter. Contractor shall also test latex type fillers for moisture content before application of top coats of paint. Do not apply any paint or sealer to any surface or to latex type filler where the moisture content exceeds seven (7) percent as measured by the electronic moisture meter.

I. Touch-Up: Prime paint all patched portions in addition to all other specified coats.

3.4 MATERIALS PREPARATION

A. Mix and prepare painting materials in strict accordance with the manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

C. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.

D. Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

E. Tube Steel and Custom Profile Steel Interiors: All hollow steel members not completely welded shut and exposed to weather shall have their interiors protected from corrosion by providing weep holes at the base of the section AND either of the following:

1. Hot dip galvanizing and then galvanizing subsequently removed from the exterior.

2. Coating with an Epoxy Primer: PPG ERP 420 or approved equal.

3.5 APPLICATION

A. General

1. Apply paint by brush, roller, or spray in accordance with the manufacturer's directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.

2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried. Sand between each enamel or varnish coat application with fine sandpaper, or rub surfaces with pumice stone where required to produce an even, smooth surface in accordance with the coating manufacturer's directions.

3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. Give special attention to insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.

a. "Exposed surfaces" is defined as those areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint, before final installation of equipment.

6. Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.

7. Finish doors on tops, bottoms, and side edges the same as the faces, unless otherwise indicated.

8. Enamel finish applied to wood or metal shall be sanded with fine sandpaper and then cleaned between coats to produce an even surface.

9. Paste wood filler applied on open grained wood after beginning to flatten, shall be wiped across the grain of the wood, then with a circular motion, to secure a smooth, filled, clean surface with filler remaining in open grain only. After overnight dry, sand surface with the grain until smooth before applying specified coat.

B. Electrostatic Painting: Apply paint of all elements in Section 051213 via electrostatic process in the shop.

1. Touch up all damaged areas, electrostatically in the field to the satisfaction of the Commissioner.

C. Scheduling Painting

1. Apply the first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

2. Allow sufficient time between successive coatings to permit proper drying. Do not re-coat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

D. Prime Coats: Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

E. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.

F. Touching-Up of Factory Finishes: Unless otherwise specified or shown, materials with a factory finish shall not be painted at the project site. No touch-up of factory finishes on site will be acceptable.

3.6 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing, and repainting, as acceptable to the Commissioner.

B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.7 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 WORK INCLUDED

A. Labor, materials, equipment and services necessary for the fabrication, delivery and installation of signage as described in the detail drawings.

B. Refer to the message schedule for a complete list of sign types and quantities. Signs listed on message schedule should match those indicated on sign location plans.

C. Signage is to be installed at the following location: Croton Water Filtration Plant, Bronx, NY

D. For all signs, all fasteners, support structures required for installation.

1.3 RELATED WORK

A. General carpentry and painting requirements: all work to be done in a professional manner and to the highest trade standards.

B. Use OSHA safety requirements as necessary for pedestrianor vehicular safety.

1.4 REGULATORY REQUIREMENTS

A. Observe applicable codes, sign ordinances and ADA guidelines for handicapped and fire/life safety signing.

B. For Electrical Work

1. National Electrical Code

2. National Electrical Safety Code

3. Life Safety Code - N FPA 101

4. OSHA

5. Applicable Federal, State and Local Codes

6. Underwriters Laboratory Inc. (UL)

1.5 REFERENCE STANDARDS

Refer to current editions of the following as applicable:

A. ASTM A36-Structural Steel

B. ASTM A123-Zinc Hot Galvanized) coatings on products fabricated from rodded, pressed and forged steel shapes, plates and bars.

C. TM B135 QQ-B-613 Fed Spec)-Brass, Muntz 280

D. ASTM B221- Aluminum-alloy extruded bars, rods, wire, shapes and tubes.

E. ASTM D822-Light and water exposure apparatus carbon-arc type) for testing paint, varnish, lacquer and related products.

F. ASTM E84-Surface burning characteristics of building materials.

G. FS L-P-391-Plastic sheet, rods and tubing, rigid, cast materials.

H. FS L-P-387-Plastic sheet, laminated, thermosetting.

I. PS-1-Construction and industrial plywood.

J. PEI-Porcelain Enamel Institute.

K. UL 943-Fluorescent lamp ballasts.

L. CDA-Copper Development Association, Inc.

M. AWI-Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute.

N. ASTM C 880-Stone, granite flexural strength testing

O. ASTM C 1354-Stone, granite anchorage testing

P. ASTM 143-74 -Concrete slump test

Q. ASTM D 3933-98 -Standard guide for preparation of Aluminum surfaces for structural adhesives bonding phosphoric acid anodizing.

1.6 SUBMITTALS

A. Requirements

1. Schedule shop drawings, product data and sample submittals for delivery at the same time.

2. The Commissioner may hold shop drawings, product data and samples in cases where a partial submittal cannot be reviewed until associated items have been received.

3. Allocate not less than four weeks, plus mailing time, for processing by the Commissioner.

B. Schedule

1. Submit schedule with all pertinent dates and milestones for the project.

2. Include submittal delivery dates, fabrication and installation dates.

3. Allow several weeks in schedule for review and revision time for all submittals.

4. Revise schedule regularly as project details dictate.

C. Shop Drawings

NOTE: All final shop drawings must have an engineering stamp from a state licensed engineer before being approved for fabrication.

1. Submit four 4) sets of shop drawings as outlined below.

2. Include plans, elevations, sections and large scale details of sign wording and lettering layout. Show anchorages and accessory items. Provide mounting templates.

3. Show fabrication and installation details, including all sign components such as extrusions, brackets, bracing, hardware, internal framing, foundations, etc.

4. Provide engineering data to confirm viability of signs and supports, including structural stability of all signs, fasteners and foundation design.

5. Structural details must be reviewed and stamped by a NY state certified structural engineer, ensuring structural integrity and safety.

D. Samples

1. Submit four (4) sets of each sample required.

2. Commissioner reserves the right to reject any samples that do not satisfy the construction, finish or color requirements. Submit additional samples as required to obtain final approval.

3. Samples shall be labeled on the back, designating item number, name of manufacturer, sign type and location. The following sample submittals are required for this project:

4. The following samples must be submitted and approved prior to the fabrication of signs:

a. 4 sets of all color samples including paint and vinyl samples on thin aluminum plates
b. Sign type S1: 24"x24" aluminum with finish and applied letterform(s)
c. Full size sign type S5 prototype on self-standing base (to be job used later)

d. Full size sign type S11 prototype on self-standing base (to be job used later)

e. Full size sign type P3 prototype on self-standing base (to be job used later)

f. Sign type sign type S3 sample letter

g. Sign type sign type S6 sample letter

h. Full size sign type S9 prototype

i. Sign type S12 sample rail panel

j. Sign type S10 – 50% reduced size sample

k. Full size sign type S4 prototype

l. Full size sign type C2 prototype

m. Full size sign type L2 prototype

n. Full size sign type C4 prototype

o. Full size sign type C5 prototype

p. Full size sign type C6 prototype

q. Full size sign type C9 prototype

5. Samples should represent extreme variations in color and texture that might occur during fabrication.

E. Maintenance Data

1. Submit two (2) copies of each manufacturer's recommendations for maintenance of all items.

2. The instructions shall cover cleaning, repair, repainting and maintenance of signs, including data on cleaning solutions or methods of application which should be avoided.

1.7 PROTECTION

A. Store and protect assemblies from injury at the shop, in transit to the job and until erected in place, completed, inspected and accepted.

B. Take special precautions to prevent pilferage both prior to and after installation. Be prepared to provide replacements for any material so removed from the site.

1.8 INSPECTION

A. Materials, colors and fabricated or partially fabricated items shall be available for inspection at the factory or elsewhere, by the Commissioner during the process of

manufacture and until final delivery, installation and acceptance, to determine whether or not there is compliance with the requirements of these specifications.

B. Approval prior to the time of final acceptance shall not preclude rejection of delivered items which do not satisfy these specifications.

1.9 WARRANTY

A. All warranties must match warranty criteria mentioned in this performance specification.

B. Fabricator to warrant all products (including, but not limited to, materials, hardware and finishes) against any and all manufacturing defects for a minimum period of 1 year from date of installation.

C. Fabricator to correct any and all defects in material and/or workmanship which may appear during the warranty period by restoring defective work to the standard of the contract documents at no cost to the owner and to the City of New York's satisfaction.

D. Fabricator to warrant vinyl die-cut letters for 1 year against delamination from substrate.

E. Fabricator to correct any and all paint finish defects which may appear during the warranty period by restoring defective work to the standard of the contract documents at no cost to the owner and to the owner's satisfaction. Paint finishes shall be warranted for 1 year against chalking and gloss fading.

F. Additional corrections shall include, but not be limited to, the following:

1. Bubbling, crazing, chalking, rusting or other disintegration of the sign face or of the messages or of the edge finish of the sign inserts or panel.

2. Corrosion developing beneath paint surfaces of the support systems (except when it is the result of obvious vandalism or other external damage to the paint surfaces).

3. Corrosion of the fastenings.

4. The signs not remaining true and plumb on their supports.

5. Fading of the colors when matched against a sample of the original color and material.

6. Discoloration of metal finishes.

7. Uneven illumination; dark or hot spots.

PART 2 - PRODUCTS

2.1 QUALITY ASSURANCE

A. Work done and materials furnished shall meet the highest industry standards in every respect and, unless otherwise specified, materials and equipment shall be new and of the latest design.

B. Use only personnel thoroughly skilled and experienced with the products and method for fabrication and installation of signage specified.

C. The Commissioner shall reserve the right to reject any shop drawings, samples or other submittals, as well as any finished product or installation, that cannot meet the standard of quality established. Any such decision will be considered final and not subject to recourse.

D. The intent of the contract documents is to provide everything necessary for a complete contract. In the event of conflict or omission, the Contractor shall consult the Commissioner for resolution.

E. Materials and hardware not specified, but necessary to the complete functioning of the sign, shall conform to the quality level established.

2.2 MATERIAL SUPPLIERS

A. Vendors and products listed below are specified for this project. These products have either been tested on prior projects and have delivered proven results, or have properties unique to this project. Any suggested substitutions must have documentation demonstrating the same level of quality and warranty.

B. Acrylic Polyurathane Paint, Matthews Paint, 800.323.6593

C. Vinyl and vinyl coatings, Oracal, 912.851.5000

D. Duranar, PPG Coatings, 1.888.774.4332

E. Or approved equal.

2.3 SIGN TYPES

A. Factory silk screen

1. On aluminum.

B. Vinyl letters or other die-cut shapes

1. On glass.

C. Cut/fabricated letters

1. Aluminum with bead blasted finish.

2. Aluminum with painted finish.

D. Aluminum structures

1. Extrusions, as noted.

2. Aluminum sheet or plate, rolled as necessary.

3. Stainless steel hardware.

E. Acrylic

1. Wall mounted with VHB tape and silicone.

2.4 DESIGN REQUIREMENTS

A. The contractor shall be responsible for the message layout of all directional message panels. Fabricator must produce scale drawings of message layouts for review prior to fabrication. Layout spacing and letterheights to be based on typical layout guideline drawing pages. Any discrepancies or unusual layout issues should be brought to the attention of the Commissioner.

B. Type specifications

1. Typeface: the following typefaces are used (NO substitutions will be accepted; if sign fabricators software or equipment uses a different "cut" or version of type specified, fabricator is required to scan correct version or otherwise arrange to procure it): See design intent drawings for font and letterspacing samples.

2. Size: all letter heights specified are based on the cap height of a capital letter.

3. Alignment: When setting type or installing cut letters, ensure that letters are perfectly straight and even, with no characters set crooked or "popping up."

4. Spacing

a. See drawings for samples of letterspacing programs. The proper letter and word spacing is of extreme importance to the desired look of the signs.

b. Contractor is responsible for visual corrections to the typesetting that might be necessary. Any problems in spacing or copyfitting should be brought to the attention of the Commissioner for solution.

C. Visual justification

1. Display type may align mechanically but not optically. When flushing copy message left, a visual adjustment shall be made compensating for those letter forms that must be extended into the left hand margin to appear flush. For example, S and O must extend beyond the left margin slightly.

D. Arrow and symbol specifications

1. Symbols: symbols and pictographs shall conform to the symbol signs issued by the NYC Department of Parks and Recreation.

2. Arrows on all signs shall use the arrow files which will be provided by the owner to the successful bidder. Arrow size will be dimensioned by height as shown in the drawings.

E. Artwork specifications

1. All artwork, and custom sign shapes for this project will be provided by the client as electronic files. Only use the layouts from these files. Do not use substitutes or attempt to re-create these images.

2. Refer to design drawings for placement of message copy and images.

2.5 MATERIALS

A. Steel angles/hardware

B. Aluminum extrusions: Shapes, sizes and weights of members shall be as required for structural stability. All connections of aluminum members shall be heli-arc welded, continuous fillets, ground smooth on all exposed faces, unless specifically detailed otherwise. Aluminum finishes shall be hereinafter specified.

C. Aluminum sheet and plate: Provide thickness as indicated. For painted finish, faces shall be etched to give an even satin finish and remove oxidation, then conversion coated to improve paint adhesion and inhibit corrosion. Surface shall be belt-sanded for a smooth finish, edges filed and ground then immersed in hot alkaline cleaner to remove contamination.

D. Hangers, brackets and accessories: shall be of the type and size indicated. Where such items are not specifically called for, provide hangers, brackets and accessories as required for the proper execution of the work, as approved by the Commissioner.

E. Paint for aluminum components:

All coatings to protect aluminum by uniformly penetrating, filling, and sealing surface pores. Coating should provide an invisible barrier to weathering, airborne contaminants, graffiti, industrial air pollution, mildew, and salt air. Coating should not yellow, peel or flake. Coating should be guaranteed a minimum of seven years. Sign panels shall be pre-drilled in proper locations before any priming, painting or coating processes. Aluminum should have consistency of color and finish throughout the project

F. Concrete: Cast-in-place concrete shall meet the following requirements:

1. All concrete footers are to be poured in place.

2. All concrete footers are to be poured from thoroughly mixed and agitated concrete in order to prevent unreasonable voids in the finished casting.

3. Concrete to meet specified "PS I Test" for strength: 3,500 psi minimum.

4. Concrete to meet specified "Slump test" before pouring footing.

5. All footings to extend past the frost line 36".

6. Any footers or posts for signs will be placed in wet concrete and allowed to fully cure in place before any signage is attached or mounted to it in any way.

7. Finish: All exposed faces of concrete shall receive a finish to match existing, adjacent surfaces.

G. Adhesives

1. Heavy gauge aluminum sheets and components - Lord 201 Acrylic adhesive or approved equal. Two-part acrylic structural adhesive for bonding metals and plastics. A High Bond Adhesive can bond both finished and unfinished surfaces. Prepare surface by removing grease, loose contaminents and oxidized spots. Apply by spraying rolling or brushing on single surface to produce bond lines 5-10 mils thick and both surfaces to produce 25-50 mils thick.

2. Liquid adhesive: Silicone Silastic 732 RTV adhesive/sealant as manufactured by Dow Corning or approved equal.

2.6 FABRICATION

A. Report any discrepancies between drawings, specifications and City of New York requirements and request direction from the Commissioner before proceeding.

B. Verify measurements in field as required for work fabricated to fit job conditions. Before starting work, examine adjoining work on which work of this section is in any way dependent for perfect workmanship and fit.

C. Make work in ample time not to delay job progress and deliver to job at such time as required for proper coordination. Fabricate work true to line and detail with clean, sharply defined profiles. Finish surfaces smooth unless otherwise specified.

D. Do cutting, punching, drilling and tapping required for attachment or other work coming in contact with signage work where indicated.

E. Changeability: fabricate signs in such a manner that each of the major mounting components may be removed and replaced with similar components by maintenance personnel, but not by unauthorized personnel.

F. Construction: fabricate all joints, corners, miters, etc., with work accurately machined, filed and fitted, rigidly framed together at joints and contact points. Carefully match all work to provide a perfect continuity of lines and design, with metal in contact having hairline joints. Make joints of such character and assembly to be strong and as rigid as adjoining sections. Make exposed joints where joint is least conspicuous. Corners shall be square as indicated. All edges shall be finished and free of saw marks. All edges exposed to pedestrian traffic shall be eased. Allow for expansion and contraction of materials from temperature changes, especially when two materials with different

coefficients of expansion are used together. Detail signs to minimize deflection from snow, ice, water or their own weight.

G. Engineering: All shop drawings must be reviewed and sealed by a state licensed engineer. All sign types shall be engineered to eliminate buckling of any members, failure at any points, distortions or other damage. The system shall be engineered to be rigid with minimum deflection and rotation under stress and shall be able to withstand movement, shear and torsional loads. Exposed areas of signs shall not oilcan. Signs shall be designed as structurally self-supporting units. The suspension systems and substructure shall be designed by the sign manufacturer to perform in accordance with the contract documents.

H. Connections and accessories: weights of connections and accessories shall be adequate to sustain and withstand stresses and strains to which they will be normally subjected.

I. Sign panels - general

1. Surface finish: provide surface finishes that are free from lines, mottling, ridges, variations in color, orange peel, bubbles, pinholes, mottling, crazing, grit and coarse particles. This applies to all methods of fabrication and finishing. Use clear coatings for durability, surface protection, appearance and maintenance.

2. Material: sign panel material is stated in the schedules under "Notes" and/or on drawings.

3. All signs shall have opaque background and opaque graphics except for glass applied film.

J. Anchors and fastenings

1. Mechanical

a. Provide anchors and fasteners required to secure work in place.

b. Surface finish: do not expose fastenings on surface of sign panels unless specifically noted otherwise. Do not deform, distort or discolor sign face surfaces by attachment of concealed fastenings.

c. Corrosion resistance: all fastenings shall be non-corrosive and resistant to oxidation or other corrosive action, of the same composition completely th rough their cross sections, particularly when used below grade. Use highest quality stainless steel hardware and fasteners.

d. Anchors, inserts or fasteners shall be compatible with sign materials, shall not result in galvanic action or chemical interaction of adhesives and shall have demonstrable and sufficient strength for intended use.

e. Steel anchors and fastenings for exterior use shall be galvanized in accordance with ASTM A153.

f. Stability: fabricate and install signs with fastenings to withstand all actions imposed by use; 30 psf wind perpendicular to surfaces, water, ice, snow loads and similar forces.

g. Anchor bolts in concrete shall be cast in place. Manufacturer shall furnish instructions for the setting of anchors and bearing plates. Manufacturer shall ascertain that the items are properly set during the process of the work.

h. Color: secure work with fastenings of same color and finish as the components they secure where they are exposed to view, unless noted otherwise.

i. Security: All exposed fasteners must be vandal resistant and have vandal-proof "spanner" type slots to be removed only with a special driver head.

K. Messages

1. Layout: layouts are shown on the drawings. All messages including braille shall be flush left, unless noted otherwise. Braille line breaks shall match those of the raised copy. Any problems in message layout shall be brought to the attention of the owner for solution.

2. Fabrication: execute all signs such that letter forms are true and clean. Letterforms with rounded corners, or chipped, nicked, cut or ragged edges, will not be accepted. This applies to all methods of fabrication and copy application.

3. Copy: message copy on detail drawings is for layout purposes only. Actual copy is listed in the "Message" column of the schedule. Certain copy may be provided later by the owner.

4. Capitalization: directions for upper and lower case are found in detail drawings must be followed exactly.

5. Single or double faces: all signs that are double sided will be noted as such in the drawings and message schedule. For double sided signs, the message will be indicated as "Side A" and "Side B" or "Side C" and "Side D".

L. Surface or subsurface-applied messages

1. Reflectivity and specular gloss

a. Nonreflectorized message: 60 degree specular in accordance with ASTM Test D5 23.

2. Thickness: as indicated in specifications herein.

3. Color and color fastness

a. Exposed surfaces and finishes shall show no discernible color change or chalking when exposed for 1,000 hours in an Atlas Twin Arc Weathermaster Model HCDL-X, or equivalent, when tested in accordance with ASTM D822.

4. Interletter spacing: follow examples in drawings. Show sample inter-letter and inter-word spacing in sample submissions as specified.

5. Layout: positions for all messages, symbols, arrows, lines, etc., for all signs are clearly indicated on the drawings and shall be complied with.

6. Artwork: contractor shall be responsible for all final reproduction artwork for all messages, symbols, arrows

7. Fabrication:

a. Screened messages: execute all silk screen printing in such a manner that all edges and corners of finished letterforms are true and clean. Letterforms, color areas or lines with rounded corners, edge buildup or bleeding, sawtoothing, etc., will not be accepted. Execute all silkscreening from photoscreens prepared from typesetter's reproduction of the copy specified. Typesetter's reproductions shall be the actual size specified. All above work is included in this contract. Hand cut screens will not be acceptable.

b. Die-cut messages: die-cut, pre-spaced, pre-aligned messages (numbers, words, phrases and arrows) from 3.0 mil flexible film coated with continuous adhesive pressure sensitive backing to meet characteristics specified for surface-applied messages. Execute die-cutting in such a manner that all edges and corners of finished letterforms are true and clean. Letterforms with round positive or negative corners, nicked, cut or ragged edges, etc., will not be acceptable.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine the substrates and conditions under which the signs are to be installed and notify the Commissioner in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sign units and components with concealed fasteners, unless otherwise shown. Refer to detail drawings for general method. Verify each surface in field to determine specific, appropriate hardware. Drawings in this package may not indicate any belowground or in-wall structural tie-ins or connections that may be necessary to assure stable and secure installation of signs. Sign fabricator is responsible for determining where such connections are necessary and for coordinating with related trades to make them.

B. Locations: refer to drawings for approximate locations. Any discrepancies or apparent deviations from drawing locations because of different site conditions shall be brought to the attention of the Commissioner for solution. The owner's rep must be present for field placement of sign. It shall be the responsibility of the Contractor to coordinate with Facilities Management to determine the need for road by the use of test pit excavation prior to excavation operations. Contractor is responsible to contact proper facilities management for utility locates not less than 48 hours before any digging.

C. Provide whatever replacement concrete, bricks, etc. are necessary to match adjacent surfaces exactly.

D. Note that this facility experiences heavy public use. Signs must be securely mounted. Contractor is responsible for suggesting alternative fabrication or installation methods if required to prevent theft or vandalism.

E. Install signs to be level, plumb and at the proper height. Cooperate with other trades for installation of sign units.

F. Clean and polish, remove excess adhesive.

3.3 CLEANUP

A. Periodically (daily) and upon completion of the installation, remove all waste, dirt, wrappings and excess materials, tools and equipment, and carefully and thoroughly clean all surfaces to the satisfaction of the City of New York.

3.4 PROPERTY DAMAGE

A. Protect all adjacent surfaces from damage and pay the cost of repairing any damage to the property caused by delivery or installation of materials. In all cases, match existing surfaces.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 102114

FLOOR MOUNTED TOILET PARTITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the floor mounted toilet partitions as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Gypsum board partitions - Section 092900.

B. Ceramic tile - Section 093000.

C. Toilet accessories - Section 102800.

1.4 QUALITY ASSURANCE

A. Field Measurements: Take field measurements prior to fabrication to ensure proper fitting of the work.

B. Inserts and Anchorages: Furnish inserts and anchoring devices which must be built into other work for the installation of toilet partitions and related work. Coordinate delivery with other work to avoid delay.

1.5 SUBMITTALS

A. Shop Drawings: Before any of the materials of this Section are delivered to the job site, submit the following:

1. Room layouts and elevations for all areas, with dimensions based on actual dimensions taken at job site.

2. Materials, finishes, details of construction, gauges of metal, hardware, fastening and anchoring conditions and relation to adjoining constructions.

B. Samples: Submit the following:

1. One 12" x 12" sample of baked enamel finish for each color indicated.

2. One sample of each type of hardware and fitting item including related fasteners. Include all items listed under 2.2 C. below.

C. Templates: Submit templates to other trades as required for support of toilet partitions.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Toilet partitions shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Metal fabrications materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section, where applicable.

PART 2 PRODUCTS

2.1 TOILET PARTITIONS /TYPES AND MANUFACTURERS

A. Provide floor mounted toilet partitions as manufactured by one of the following:

1. Bradley

2. Bobrick

3. Or approved equal

B. PP-01: Metal Toilet Compartment - Floor Braced Series 500, with Permaseal Edge, by Bradley or approved equal.

C. Manufacturer's name or identifying markings are not permitted on exposed surfaces of metal toilet partition, vision screen, or related hardware.

2.2 URINAL SCREENS /TYPES AND MANUFACTURERS

A. Provide wall-hung urinal screens as manufactured by one of the following:

1. Bradley

2. Bobrick

3. Or approved equal

B. Manufacturer's name or identifying markings are not permitted on exposed surfaces of metal toilet partition, vision screen, or related hardware.

2.3 MATERIALS FOR TOILET PARTITIONS AND SCREENS

A. Steel Sheet for Baked Enamel Finish: Prime quality carbon steel, cold rolled, stretcher leveled, galvanized (0.00015" thick galvanized coating on each face) and bonderized.

B. Core Insulation: Manufacturer's standard rot-proof and vermin-proof double faced honeycomb or corrugated type core material; required in all panels, screens, pilasters and doors.

C. Hardware: Solid forged brass or stainless steel (Type 302 or 304), as indicated below. Stamped, cast alloy, or aluminum extrusions shall not be accepted.

1. Pilaster Shoes: Stainless steel, one piece (no visible joints or seams) flush or offset design, twenty (20) gauge.

2. Hinges: Gravity hinge type, self-closing, concealed within door, fully adjustable, to bring door to rest in thirty (30) degree open position. Hinge brackets solid forged brass or stainless steel, with solid stainless steel pin and pintles.

3. Latch: Solid forged brass with solid stainless steel slide.

4. Strike and Keeper: One piece, solid forged brass or sixteen (16) gauge stainless steel, with rubber bumper mechanically applied and theft proof.

5. Bumper Coat Hook: Solid forged brass, with ferrule held rubber bumper on back of each toilet compartment door.

6. Stirrup Brackets: Fourteen (14) gauge stainless steel or forged brass.

7. Hardware Finishes

   a. On Forged Brass: Heavy chromium plating over nickel over copper. Satin Finish (US26D).
   b. On Stainless Steel: No. 4, Satin Finish.

D. Fasteners: Provide exposed fasteners of stainless steel or chromium plated brass, same finish as adjoining metal, theft proof. Provide concealed fasteners of non-corrosive metal.

E. Furnish galvanized steel anchorage devices, complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters, to permit structural connection at floor. Furnish shoe at each pilaster to conceal anchorage.

2.4 FABRICATION

A. Minimum Acceptable Metal Gauges

1. Face Sheets for Panels and Screens: Twenty (20) gauge steel sheet.

2. Face Sheets for Doors: Twenty-two (22) gauge steel sheet.

3. Face Sheets for Pilasters: Sixteen (16) gauge steel sheet for baked enamel finish, unless otherwise indicated.

   a. For pilasters less then four (4) inches wide - fourteen (14) gauge.

4. Edge Moldings: Eighteen (18) gauge galvanized, bonderized steel.

5. Concealed Reinforcement: Fourteen (14) gauge galvanized steel for tapping and twelve (12) gauge galvanized steel for anchoring devices.

B. Thicknesses

1. Panels, Screens and Doors: One (1) inch overall thickness.

2. Pilasters: 1-1/4" overall thickness.

C. Sizes: As shown on drawings. Pilasters for compartments shall all be of the same width, except end pilasters which shall be approximately 1/2 the normal width.

D. Construction

1. Panels, screens, doors and pilasters shall have face sheets, with formed edges, pressure cemented to each side of core insulation, providing flat, smooth surface, free of waves, warping, buckles or other defects.

2. Lock edges of face sheets together by either concealed tack welding face sheets at contacting edges at eight (8) inches o.c. and installing interlocking edge molding, or by using a combination integral edge molding and internal reinforcing channel epoxy bonded to face sheets.

3. Edge molding shall have corners mitered, welded or brazed, ground flush and finished to match adjacent surfaces. Corners, caps or exposed welds not permitted.

4. Provide concealed reinforcement for hardware, grab bars, fastenings and accessories specified for in both work of this Section and in work of other Sections (such as Toilet Accessories), and for rigidity, strength and support of units in accordance with requirements of type and use of metal toilet partitions. Cut partitions in shop to receive toilet accessories, using templates furnished by Section 102800.

E. Compartment Sizes: Unless otherwise indicated, minimum dimensions of components for toilet compartments shall be as follows:

1. Enclosure Height: 5'-10".

2. Typical Door Width: 2'-0".

3. Door Width for Barrier Free Compartments: 2'-10".

4. Door Height: 4'-0".

5. Floor Clearance: 1'-0".

2.5 FINISHES

A. Baked Enamel Finish: Clean steel sheet and surfaces and factory apply one (1) coat of rust inhibitive baked-on primer and two (2) coats of synthetic semi-gloss baked-on enamel on all exposed surfaces.

1. Colors: As selected by Commissioner.

B. Touch-Up Paint: Furnish City of New York with one (1) gallon of each color of enamel finish paint for City of New York's use.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where floor mounted toilet partitions are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install work of this Section in a rigid and permanent manner, straight and plumb, with all horizontal lines level.

B. Install panels and doors twelve (12) inches above finished floor, unless otherwise indicated. Toilet compartment doors shall be centered on water closets, unless otherwise indicated.

C. Maintain uniform clearance of approximately 1/2" between pilasters and panels, and 1/2" between pilasters or panels and finished wall.

D. Maintain uniform clearance of 1/4" or less between vertical edges of doors and pilasters.

E. Set pilaster units with anchorages having not less than two (2) inches penetration into structural floor. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.

END OF SECTION

SECTION 102213

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the wire mesh partitions as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Concrete - Section 033000.

B. Masonry - Section 042000.

1.4 REFERENCES

A. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

B. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus

C. ASTM D822 – Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus

D. ASTM D2784 – Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

E. ASTM D3363 – Test Method for Film Hardness by Pencil Test

1.5 QUALITY ASSURANCE

A. Provide products of the standard best quality for the particular kind of material specified.

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's latest published literature for approval. Obtain approval before materials are delivered to the job site.

B. Submit installation shop drawings for locations as indicated on the contract drawings. Shop drawings shall indicate elevations, sections, methods of anchoring and connecting to surrounding construction.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Wire mesh partitions shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Wire mesh partitions materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing

system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.8 DELIVERY, STORAGE AND HANDLING

A. Avoid damage to items during transit and delivery. Do not set work damaged in transit; replace with undamaged material without additional cost to the City of New York.

B. A space at the building shall be designated for the storage of material provided under this Section. The responsibility for all such material shall, however, rest entirely with the Contractor until it has been set and accepted as complete in accordance with the Contract requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Materials shall be of the minimum size specified herein. Larger sizes shall be used where recommended by the manufacturer or as indicated on Contract Drawings.

B. Cut-outs shall be provided for beams, ducts, pipes and other items as necessary for installation of partitions. All edges shall be finished to provide a neat, protective edge at the cut-outs.

C. Acceptable Manufacturers: Ametco, Acorn Wire and Iron Works, Inc., Miller Wire Works, Inc., The G/S Co. or approved equal.

D. PP-03: Wire Mesh Partition

1. Steel Security Fence, 'Stadium' design, by Ametco, or approved equal by one of the other acceptable manufacturers indicated above.

2. Color: As selected by Commissioner from manufacturer's standard colors.

3. Location: As indicated on Contract Drawings.

2.2 WIRE MESH PARTITIONS

A. Vertical Main Bars: 1 inch by 1/8 inch flat bars spaced at 3 15/16 inches.

B. Horizontal Cross Rods: 3/16 inch diameter rods spaced at 5 3/16 inches.

C. Top and Bottom Perimeter Bars: 1 inch by 1/8 inch.

D. Panel Height: As indicated on Contract Drawings.

E. Panel Width: As indicated on Contract Drawings.

F. Posts: Galvanized flat steel bars, size and length as indicated on Contract Drawings.

2.3 DOORS, WINDOWS AND ACCESSORIES

A. Provide gates of type and size as indicated on Contract Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.

1. Construction: Welded frame fabricated from steel tubing, size as indicated on Contract Drawings, with open grille steel panels to match wire mesh partition panels.

2. Hardware

a. Hinges: Size and type as determined by manufacturer. Provide two hinges for each leaf up to six feet high and one additional hinge for each additional 24 inches in height or fraction thereof.
b. Latch: 3/4 diameter slide bolt to accommodate padlock.
c. For double gates, provide padlockable, 5/8 inch diameter center cane bolt assembly and strike.
d. Provide anti-intruder bolts consisting of cup head bolt and nut with clamping hexagon such that tightening shears hexagon and render bolt impossible to release.

2.4 FINISH

A. Wire mesh partitions and all accessories shall be hot dip galvanized to 1.25 ounces per square foot minimum zinc coating in accordance with ASTM A123. Standard size components shall receive polyester powder coating. Large gate panels shall be coated with two-part polyurethane coating.

B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

1. Minimum hardness measured in accordance with ASTM D3363: 2H.

2. Direct impact resistance tested in accordance with ASTM D2794: Withstand 160 inch-pounds.

3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16 inch undercutting.

4. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.

C. Polyurethane coating: 1.0 mil dry film thickness of coating of steel test panel cured 30 minutes at 180 degree F and aged 14 days shall resist the following test conditions without failure:

1. 5 percent salt spray for 500 hours.

2. 100 percent relative humidity for 1000 hours.

3. Water immersion for 100 hours.

4. 20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.

5. Exposure to lubricating oils, hydraulic fluids, and cutting oils.

6. 16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 degrees F, and 24 hours at 77 degrees F.

7. Hardness: H to 2H.

8. Flexibility: 1/8 inch conical mandrel.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where wire mesh partitions are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. All work is to be executed by skilled mechanics and shall be of the finest quality, neat in appearance and free from defects.

B. Erect partitions plumb, rigid, properly aligned and securely fastened in place, complying with the drawings and manufacturer's recommendations.

C. Provide additional field bracing as necessary for a rigid, secure installation.

D. Adjust moving components for smooth operation without binding.

E. Touch-up damaged finish after completion of installation using field-applied paint to match color of shop applied finish.

3.3 ADJUST AND CLEAN

A. Clean and leave free from blemishes, defects and dirt.

B. Replace any damaged units at no additional cost to City of New York.

C. Adjust hardware for maximum efficiency.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 102226

OPERABLE PARTITIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the operable partitions as indicated on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Structural steel support - Section 051200.

B. Wood blocking - Section 062000.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and installation instructions for each type of operable partition and installation accessory required.

1. Submit written data on physical characteristics, durability, resistance to fading and flame resistance characteristics.

B. Shop Drawings: Submit shop drawings showing location and extent of operable partitions. Include plans, elevations, and large scale details of anchorages, and accessory items. Indicate location of each unit with building, conditions at openings, typical for special details, location and installation requirements for hardware and operators.

1. Include methods of installation for each type of support structure and fastening condition.

C. Template Drawings: Submit location template drawings for items supported or anchored by permanent construction.

D. Maintenance Data: Include complete Maintenance Manual.

E. Samples for Initial Selection Purposes: Manufacturer's standard color charts showing full range of colors and materials for each component exposed to view, available for each type of operable partition required.

F. Samples for Verification Purposes

1. 12" square samples of finish selected.

2. Prepare samples form same material to be used for the work.

G. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm (material producer) with not less than three (3) years of production experience, whose published literature clearly indicates general compliance of products with requirements of this section.

B. Installer Qualifications: Firm specializing in operable partition installation with not less than two (2) years of experience in installation of operable partitions similar to those required for this project.

C. Single Source Responsibility: Provide material produced by a single manufacturer partitions and mounting hardware.

D. Certification: Submit manufacturer's certificate stating that materials furnished comply with specified requirements. Include supporting certified laboratory testing data indicating that material meets specified test requirements.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Steel panels shall contain a minimum of 20% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Exterior stone cladding materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.7 REFERENCED STANDARDS

A. ASTM C-423: Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E-84: Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E-90: Method for Laboratory of Airborne Sound Transmission Loss of Building Partitions.

D. ASTM E-557: Practices for Architectural Application and Installation of Operable Partitions.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, fire hazard classification, and lot number. Store materials in original undamaged packages and containers, inside well ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat, blocked off ground to prevent sagging and warping. Comply with instructions and recommendations of manufacturer for special delivery, storage, and handling requirements.

1.9 SEQUENCING AND SCHEDULING

A. Sequence operable partition installation with other work to minimize possibility of damage and soiling during remainder of construction period.

1.10 WARRANTY

A. This warranty shall be in addition to and not a limitation of other rights the City of New York may have against the Contractor under the Contract Documents.

1. Warranty period is one (1) year after the date of substantial completion.

1.11 GUARANTEE SERVICE

A. Guarantee Service Instructions: Submit manufacturer's printed instructions for service of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and methods which may be detrimental to finishes and performances.

PART 2 PRODUCTS

2.1 OPERABLE PARTITION SYSTEM

A. PP-02: Operable partition system shall be equal to Variotec Series, Trimless, individually hinged, top supported, manually operable wall system by Kwik-Wall Co., or approved equal.

2.2 PANEL CONSTRUCTION

A. Manufacturer's standard glazed panels, reinforced as required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with maximum 3/16" gap between panels and with concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

B. Standard panel dimension: 1-7/16" thick nominal.

C. Horizontal Top and Bottom Glass Retainers: Patch type one-piece structural grade aluminum assemblies, with removable cover plates and end caps, located in each panel corner. Provide cam lock feature for positive mechanical attachment to glass.

D. Bottom Glass Retainer Locking System: Provide the following on each bottom glass corner retainer:

1. Standard operable floor lock.

2. Optional Keyed/Thumb Turn.

E. Glass: 1/2" thick, Clear Satin Etched translucent tempered glass manufactured in accordance with ASTM C 1036-01, ASTM C 1048-04 and ANSI Z97.1.

2.3 OPERATION

A. Individual panels top supported by two carriers riding through radius curve and diverter type intersections.

2.4 STACK ARRANGEMENTS

A. Panel storage configuration shall be as indicated on the Drawings.

B. Panels shall be stored in designated stack area as required for panel storage.

2.5 FINISHES

A. Panel cover caps for corner glass retainers shall be stainless steel stain effect.

B. Pull handle finish shall be standard stainless steel stain effect.

2.6 PERIMETER TRIM AND SEALS

A. Standard trimless tempered glass with sanded/beveled edge.

2.7 CLOSURE SYSTEMS

A. Initial closure system: First panel exiting the stack shall intersect vertically against a rigid wall surface utilizing a face-activated foot lock with dust-proof strike recessed in floor. Trail edge of lead panel shall contain a foot-operated floor lock.

B. Final closure system: Last panel at stack end shall provide method for affecting final closure of moveable glass wall system. Type of final closure panel shall be as required by configuration shown on Drawings.

2.8 ACCESSORIES

A. Floor guide channel: Clear anodized extruded aluminum channel recessed into floor, top flush with finish floor.

B. Track system: Clear anodized extruded structural grade aluminum curve and diverter aluminum track. Track shall utilize in line track splice connectors reinforced overhead by heavy duty steel drop rod brackets with pair of steel rods extending to overhead structural support. Intersections shall be structural grade aluminum fastened together to form complete assembly.

C. Carrier System: Each panel shall be top supported by two carriers utilizing 9/16" diameter pendant bolts. Each carrier shall contain permanently lubricated, ball bearing steel wheels with high density polymer tires for ease of panel movement.

D. Suspension System: Track system shall be supported by steel drop rod brackets with adjustable drop rods (grade 2, 3/8" diameter threaded steel rod with 3/8" serrated steel nuts).

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where operable partition is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not

proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install operable partitions and accessories after finishing operations, including painting, have been completed.

B. Install operable partitions in conformance with drawings, approved shop drawings and using method indicated in strict compliance with manufacturer's written installation instructions; complying as applicable with ANSI E-557, Standard Recommended Practice for Architectural Application and Installation of Operable Partitions.

C. Lubricate bearings and sliding parts; adjust to ensure smooth, easy operation.

3.3 CLEANING

A. Clean all operable partition surfaces and clean adjacent surfaces soiled by work of this Section. Avoid use of abrasive cleaners or solutions containing corrosive solvents.

B. Remove debris created by operable partition work from work site.

C. Protect partitions against damage during construction period. Ensure that partitions will be without damage or deterioration at time of substantial completion.

3.4 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to City of New York's personnel.

END OF SECTION

SECTION 102800

TOILET ACCESSORIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the toilet accessories as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Masonry - Section 042000.

B. Gypsum board partitions - Section 092900.

C. Ceramic tile - Section 093000.

D. Toilet partitions - Section 102114.

1.4 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

B. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units. Accessories shall be installed at heights in compliance with prevailing Handicapped Code.

C. Products: Unless otherwise noted, provide products of same manufacturer for each type of unit and for units exposed in same areas.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, catalogue cuts and installation instructions for each toilet accessory.

B. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices in other work

C. Submit schedule of accessories indicating quantity and location of each item.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Toilet and bath accessories shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Toilet and bath accessories materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing

system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.7 PRODUCT HANDLING

A. Deliver accessories to the site ready for use in the manufacturer's original and unopened containers and packaging, bearing labels as to type or material, manufacturer's name and brand name. Delivered materials shall be identical to approved samples.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gauge minimum, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Galvanized Steel Sheet: ASTM A 653, G60.

D. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

E. Mirrors: ASTM C 1503, mirror glazing quality, clear glass mirrors, nominal 1/4" thick.

2.2 FASTENING DEVICES

A. Exposed Fasteners: Theftproof type, chrome plated, or stainless steel; match finishes on which they are being used.

B. Concealed Fasteners: Galvanized (ASTM A 123) or cadmium plated.

C. No exposed fastening devices permitted on exposed frames.

D. For metal stud drywall partitions, provide ten (10) gauge galvanized sheet concealed anchor plates for securing surface mounted accessories.

2.3 FABRICATION

A. General: Stamped names or labels on exposed faces of toilet accessory units are not permitted. Unobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required for a particular type of toilet accessory, provide same keying throughout project. Furnish two keys for each lock.

B. Surface-Mounted Toilet Accessories, General: Fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage.

C. Recessed Toilet Accessories, General: Fabricate units of all welded construction, without mitered corners. Hang doors of access panels with full-length stainless steel piano hinge. Provide anchorage which is fully concealed when unit is closed.

2.4 MANUFACTURERS

A. Provide products manufactured by Bobrick Washroom Equipment Co., American Specialties, Inc., Bradley Corp., A & J Washroom Accessories, Excel Dryer, Inc., Koala Kare, or approved equal.

2.5 ACCESSORY SCHEDULE

A. Unless otherwise noted, model numbers used herein are those of Bradley Corp. Other manufacturers as listed herein (or approved equal) may substitute their products with the approval of the Commissioner.

B. TA-00: Hand Soap Dispenser (Recessed), Model 6334 by Bradley Corp.; 3-1/2" spout lavatory-mounted pump.

C. TA-01: Grab Bars, Model 817 (exposed mounting, stainless steel), and 812 (concealed mounting, stainless steel) by Bradley Corp.

D. TA-02: Fix Tilt Mirror, Model 7405-2436-2 by Bradley Corp.; surface mounted, satin stainless steel, tempered glass.

E. TA-03: Mirror, Model 780-2436-2 by Bradley Corp.; surface mounted, satin stainless steel, tempered glass.

F. TA-04: Waste Receptacle (Recessed), Model 2251 by Bradley Corp.; satin finish stainless steel.

G. TA-05: Tampon Dispenser (Recessed), Model 4017 by Bradley Corp.; satin finish stainless steel.

H. TA-06: Toilet Tissue Dispenser with Waste Receptacle (Recessed), Model 5942 by Bradley Corp.; satin finish stainless steel.

I. TA-07: Not Used.

J. TA-08: Robe Hook, Model 9124 by Bradley Corp.

K. TA-09: Shower Curtain, Rod and Hooks, Model 953 and 9537 by Bradley Corp.

L. TA-10: Electric Hand Dryer, Model 13043-01 Dyson Airblade 120V.

M. TA-11: Shower Bench, Model B517 by Bobrick.

N. TA-12: Seat Cover Dispenser, Model 583 by Bradley Corp.

O. TA-13: Toilet Tissue Dispenser, Model 5402 Surface Mounted by Bradley Corp.; satin finish stainless steel.

P. TA-14: Napkin Disposal, Model 4781-15 by Bradley Corp.

Q. TA-15: Shelf, Model 7510 by Bradley Corp.

R. TA-16: Diaper Changing Station, Model KB110-SSWM by Koala Kare.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where toilet accessories are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 PREPARATION

A. Accessories which are to be partition mounted shall be closely coordinated with other trades, so that the necessary reinforcing is provided to receive the accessories.

B. Furnish templates and setting drawings and anchor plates required for the proper installation of the accessories at gypsum drywall and masonry partitions. Coordinate the work to assure that base plates and anchoring frames are in the proper position to secure the accessories.

C. Verify by measurements taken at the job site those dimensions affecting the work. Bring field dimensions which are at variance with those on the approved shop drawings to the attention of the Commissioner. Obtain decision regarding corrective measures before the start of fabrication of items affected.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

3.3 INSTALLATION

A. Install accessories at locations indicated on the drawings, using skilled mechanics, in a plumb, level and secure manner.

B. Concealed anchor assemblies for gypsum drywall partitions shall be securely anchored to metal studs to accommodate accessories. Assemblies shall consist of plates and/or angles tack welded to studs.

C. Secure accessories in place, at their designated locations by means of theftproof concealed set screws, so as to render removing of the accessory with a screwdriver impossible.

D. Unless otherwise indicated, accessories shall conform to heights from the finished floor as shown on the drawings. Where locations are not indicated, such locations shall be as directed by the Commissioner.

E. Installed accessories shall operate quietly and smoothly for use intended. Doors and operating hardware shall function without binding or unnecessary friction. Dispenser

type accessories shall be keyed alike. Prior to final acceptance, master key and one duplicate key shall be given to City of New York's authorized agent.

F. The Commissioner shall be the sole judge of workmanship. Workmanship shall be of the highest quality. Open joints, weld marks, poor connections, etc., will not be permitted. The Commissioner has the right to reject any accessory if he feels the workmanship is below the standards of this project.

G. Grab bars shall be installed so that they can support a three hundred (300) lb. load for five minutes per ASTM F 446.

3.4 CLEANING AND PROTECTION

A. Upon completion of the installation, clean accessories of dirt, paint and foreign matter.

B. During the installation of accessories and until finally installed and accepted, protect accessories with gummed canvas or other means in order to maintain the accessories in acceptable condition.

C. Replace and/or repair installed work which is damaged or defective to the City of New York's satisfaction, at no additional cost.

END OF SECTION

SECTION 107500

FLAGPOLES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Flagpoles

1.3 RELATED SECTIONS

A. Cast-In-Place Concrete – Section 033000

B. Sheet metal flashing - Section 076200.

1.4 REFERENCES

A. AISI 302/304 – Stainless Steel Alloy

1.5 QUALITY ASSURANCE AND QUALIFICATIONS

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Manufacturing Standards: Provide each flagpole as a complete unit produced by a single manufacturer including fittings, accessories, bases and anchorage devices.

C. Pole Construction: Construct pole and ship to Site in one piece, if possible. If more than one piece is necessary, provide snug-fitting, precision joints with self-aligning, internal splicing sleeve arangement for weather-tight, hairline field joints.

1.6 SUBMITTALS

A. Product Data

1. Materials list of items proposed to be provided under this Section.

B. Submit the following in accordance with the DDC General Conditions.

1. Design Analysis: The design analysis shall be submitted as one package with the Working Drawings. The design analysis, signed and sealed by a registered Professional Engineer licensed in the State of New York, shall include a list of the design loads, and complete calculations for the flagpole, its components and the supports. Formulas and references shall be identified. Assumptions and conclusions shall be explained, and cross references shall be provided. The design shall include, but is not limited to, the following:

    a. Wind forces.

2. Working Drawings consisting of catalog cuts, design and erection detail drawings, instruction manual, manufacturers' recommended erection methods and procedures and other data necesssary to clearly describe design, material, sizes, construction details, fasterners, erection and sufficient detail to show interface of the work of this Sections with the work of adjacent trades. Submit manufacturer information, specifications and installations instructions for components and accessories.

3. Provide project locations where the manufacturer's flagpoles of similar design have been used shall be included with the Working Drawings and shall include information regarding date of installation and the names, telephone numbers and addresses of the owners.

C. Structural design of flagpoles shall be accompanied by load values and a letter of certification, signed and sealed by a registered Professional Engineer licensed in the State of New York, stating the design criteria and procedures used and attesting to the adequacy of the design. A written narrative of the computer program delineating the basic design methodology shall be included in the submittal. The program output shall be annotated and supplemented with sketches to make it easier for an Engineer unfamiliar with the program to verify the input and output. The design analysis shall include the name and phone number of the designer and checkers who function as a point of contact to answer questions during Working Drawing review.

D. Leed Submittal Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 LEED Certification Requirements). Information to be supplied for this Form shall include:

    a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and materials-only cost.

    b. The percentages (by weight) of post-consumer and /or post-industrial recycled content in the supplied product(s).

    c. Indication of whether the manufacturing lcoation of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufacturered.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g. recycled content, VOC content).

3. For products and materials in LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed on the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Flagpole shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Specification section 013010, Article 1.04 and 1.06.

B. Flagpole materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Specification section 013010, Article 1.04.

1.8 PRODUCT HANDLING, DELIVERY, AND STORAGE

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Spiral wrap flagpoles with heavy Kraft paper or other protective wrapping and prepare shipment in hard fiber tube or other protective container.

D. Deliver flagpoles and accessories completely identified for installation procedure. Handle and store flagpoles to prevent damage or soiling.

E. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.1 FLAGPOLE

A. Stainless Steel Flagpole: AISI 302/304 alloy, seamless construction with No. 4 finish as described in General Specification 05061, Table 2. Fabricate shop and field joints without use of pins, rivets, bolts, screw collars or lead caulking.

B. Flagpole design: Cone Tapered.

C. Manufacturer:

1. Pole-Tech, Inc.

97 Gnarled Hollow Road

East Setauket, New York 11733

Tel: 631-689-5525

Fax: 631-689-5525

Email: info@poletech.com

2.2 FLAGPOLE MOUNTING

A. Provide manufacturer's standard ground-mounted base system for the type of flagpole installation required with internal positive lighting protection.

B. Base Plate: Provide for anchor-bolt mounting, furnish manufacturer's standard cast metal shoe base of same material as flagpole. Furnish and install bolts and lightening ground spike as required.

2.3 FITTINGS

A. Stainless Steel Revolving Hood and Truck: With two sheaves that rotate on stainless steel pins; Truck and Hood revolve on stainless steel needle bearing mounted on a stainless steel pin. Finish to match pole.

B. 7 x 19 Stainless Steel Aircraft Cable with Plastic Ball, (2 EA) Stainless Steel Snaphook, Stainless Steel Thimble, Stainless Steel Quicklink, Neopreene Coated Counterweight, and Plastic Bead Retaining Loop.

C. Stainless Steel Winch: Manually operated with a positive locking friction brake.

D. Flag: Flag shall be 200 denier nylon, 10' x 15' American flag as manufactured by Art Flag Co., New York, New York, or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where flagpoles are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

C. Excavation: Excavate for foundation concrete to neat clean lines in undisturbed soil. Provide forms qhere required due to unstable soil conditions. Remove wood, loose soil, rubbish and other foreign matter from excavation and moisten earth before placing concrete.

D. Concrete: Provide concrete to attain 28-compressive strength of not less than 3000 psi complying with Section 033000.

1. Place concrete immediately after mixing. Perform chuting to avoid segregation of mix. Compact concrete in place by use of vibrators. Mist-cure exposed concrete for not less than seven days or use a non-staining curing compound in cold weather.

2. Finish trowel exposed concrete surfaces to smooth, dense surfaces. Provide positive slope for water runoff to base perimeter.

E. Flagpole Installation: Install flagpole as shown on the Contract Drawings and in compliance with the final Working Drawings and manufacturer's instructions as approved by the Engineer.

1. Provide positive lightening ground for each flagpole installation.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 109000

PARKING/ACCESS CONTROL GATE

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish and install parking/access control gate and associated components as shown on the Drawings and as specified herein.

1.3 RELATED SPECIFICATIONS

A. Miscellaneous metals – Section 055000.

1.4 SUBMITTALS

A. Product Data.

B. Shop Drawings for all equipment, wiring and installation of the arm barrier gate, the token collector, the lit 'FULL' sign, and the vehicle detection loops.

C. Qualifications.

D. Samples

1. Actual samples of custom paint colors.

2. Barrier arm sample, 12" long x actual dimensions. Sample shall show finished wood with 2 coats of sealant, reflective tape, and text. Sample shall be resubmitted until approved, at no additional cost.

3. Touch-up paint and technique prior to any touch-up work.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Detailed Specification 018113 – LEED Certification Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Detailed Specification 01301 – LEED Certification Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 QUALITY ASSURANCE

A. Single Source: All parking/ access control gate components will be from a single manufacturer, and all covered under the same warranty.

B. Guarantee: Installer shall provide a 1-year guarantee that covers all repairs and replacement for non-intentional damage.

C. Coordination: Contractor shall coordinate between trades to ensure that the gate and gate components installation has the necessary utilities in the correct locations. Utilities in the incorrect location shall be relocated and any disturbed site work will be corrected or rebuilt at no additional cost to the satisfaction of the Commissioner.

D. Installer Qualifications: An experienced Installer who has completed installations similar in material, design, and extent to that indicated for this project in the last 3 years and whose work has resulted in successful construction installations.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Parking/Access Control Gate shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Section 018113, Materials Reporting Form, Article 1.06.

B. Parking/Access Control Gate materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Section 018113, Materials Reporting Form, Article 1.06.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide sensor/token operated parking access gate system by Cincinnati Gate Systems, or equivalent product of DoorKing, Time & Parking Controls, Inc., or approved equal.

1. CG1000 Parking/Access Control Gate

a. Weatherproof and corrosion-resistant all-steel cabinet, powder coated with custom color paint finish approved by the Commissioner from a range of samples. 14 inches by 15 inches by 40 inches 12 gauge steel with a 13 inches by 14 inches by 6.25 inches polishes stainless steel base.
b. Safety proximity sensor package to prevent gate from striking pedestrians and vehicles.
c. 1/3 HP, single phase, instant reversing motor, 115/220V AC, 50/60 Hz.
d. Limit switch to control gate travel so no brake device is required.
e. Cabinet heater: 500 W thermostat controlled strip device.
f. Drive: Heavy duty, high cycle speed reducer with 60:1 output to the main shaft to raise or lower gate arm in five seconds.
g. Remotely programmable microprocessor controller.
h. Multiple operation modes.
i. Gate operation counter built into software.
j. Reset thermal overload protection.
k. Shear/Spring Pin: Connection from main gate shaft to gate arm bracket shears off to prevent damage to internal mechanism in case of sudden gate stoppage.
l. Barrier Arm
1). Natural Redwood: 'Clear All Heart' Grade or better, with no knots or surface imperfections, with the grade marked by accredited inspection bureau (Redwood Inspection Service or approved equal).
2). Sealant Coating: Clear Water Seal for exterior wood.
(a). Advanced Clear Multi-Surface Waterproofer, comprised of Mineral Spirits, Hydrotreated Heavy Petroleum Naphtha, Light Aliphatic Hydrocarbon, Paraffin Oil, Ethyltoluene and Naphthalene – Water-based formula for waterproofing protection for wood. Long-lasting beading and waterproofing. Seal shall protect but allow wood to gray naturally. Apply in quantity and number of coats as directed by the manufacturer.
3). Reflective Tape and Reflective Lettering: Reflective Tape/ Pressure Sensitive Adhesive (PSA). Films are composed of wide angle, exposed retroreflective lenses bonded to an adhesive. Reflective material shall meet ASTM D 4956, Type III, and Engineering Grade 7 year Outdoor, be appropriate for exterior use on wood substrate and meet the standards of NYCDOT. White or silver color.

2. CG2100-1 Gate Controller

   a. Self-contained universal gate control device. Lane mode selection via RS-232/485 port on main CPU from laptop or desktop computer. 8 opt-isolated inputs and 4 opt-isolated outputs, 5-30V DC range wet or dry.
   b. Convenience outlet, 110V AC, 60 Hz, 15 Amps
   c. Service Switches: Three position switch to raise gate, lower gate, and normal operation mode, power on/off switch, and heater/fan control switch.
   d. Microprocessor: 20 MHz PIC processor
   e. Vehicle Detection: PC board with on 11 pin amphenol connector for single or dual channel detectors.
   f. House gate controller inside gate cabinet (CG1000) for protection.

3. Preformed Vehicle Detection Loop, Saw Cut Style, 14AWG XHHW (XLP-E) insulated AWG copper wire.

   a. Loop and Lead-In: One continuous length of 14 AW XHHG (XLP-E) insulated, 7 strand bare copper conductor through loop turns and lead-in. Machine twisted lead-in with a minimum of 6 turns per foot. All loop wires are held securely together with a 5.0 mil polypropylene back tape.
   b. Wire: 14 AWG XHHW Cross linked polyethylene insulation conductor – bare copper, 7 strand, 90 deg C, 600V. Insulation thickness 30 mil nominal, overall diameter .140 inch nominal.
   c. Saw Cut Loop Width: .142 inch
   d. Height: Manufacturer's standard, based on number of loop turns.

4. CGTCU300 Token/Coin Acceptor: Token Acceptor shall operate the exit barrier arm gate.

   a. The token acceptor door plate shall be polished stainless steel with key access. The steel supports and body shall be powder coated steel with a custom color to match the barrier arm cabinet.
   b. 125 W thermostat controlled heater device.
   c. 115V AC 50/60 Hz Input power.
   d. Output signal 12VDC 1.5 Amps.
   e. Fuse Bus: 20 Amps single circuit.

5. Lot Full Sign: Manufacturer's standard sign indicating "FULL" when lit.

PART 3 EXECUTION

3.1 INSPECTION

A. The Contractor shall examine the alignment of the substrate and conditions under which the parking/access control gates work is to be performed and notify Engineer in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 CUTTING, FITTING AND PLACEMENT

A. Perform cutting, drilling and fitting required for installation. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.

B. Barrier Arm: Barrier arm shall have a clean reveal at the reflective tape location, as per the drawings, with a single 1/8" tolerance from horizontal for the extent of the arm. The arm shall be sanded to a smooth finish, cleaned, and sealed as per sealant manufacturer's directions. The reflective tape shall be cleanly applied in a single piece, with no overlaps, air pockets or imperfections, with a 1/16" from horizontal tolerance for the extent of the arm. The reflective lettering shall be applied cleanly with horizontal tolerance of 1/32" between letters and 1/16" tolerance from plumb.

C. Fit exposed connections accurately together to form tight hairline joints. Do not cut or abrade the surface of units which have not been finished after fabrication, and are intended for field connections.

3.3 ALIGNMENT AND ADJUSTMENT

A. Adjust gates prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction.

3.4 INSTALLATION

A. Erect parking/access control gate plumb, rigid, properly aligned and securely fastened in place, complying with the drawings and manufacturer's recommendations.

B. Additional field bracing shall be provided as necessary for a rigid, secure installation.

C. Moving components shall be adjusted for smooth operation without binding.

3.5 ADJUSTING AND CLEANING

A. Repair damaged and defective work where possible to eliminate functional and visual defects; where not possible to repair, replace parking/access control gate.

B. Touch-up damaged finish after completion of installation using field-applied paint to match color of shop applied finish.

C. Submit touch-up paint and technique for approval by the Commissioner prior to touch-up work being performed.

3.6 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that parking/access control gate is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 110100

FALL PROTECTION SYSTEM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish and install fall protection anchors as shown on the Contract Drawings and as specified herein.

B. This specification is intended to cover the performance requirements of the complete design, manufacture, and installation of the exterior fall protection system and all work and material necessary to accomplish this complete installation, except that which is specifically excluded.

1.3 RELATED SECTIONS

A. Sustainable Requirements– Section 013010

B. Structural Precast Concrete - Section 034100

C. Structural Steel – Section 051200

D. Vegetated Roofing System – Section 073360

E. Fluid Membrane Waterproofing – Section 071413

F. Roof Specialties and Accessories – Section 077100

G. Joint Sealers – Section 079200

1.4 REFERENCES

A. AISC "Load and Resistance Factor Design Specification for Structural Steel Buildings."

B. AISC "Manual of Steel Construction, Allowable Stress Design."

C. AWS D1.1-2000-Structural Welding Code – Steel.

D. IWCA I-14.1-2001 Window Cleaning Safety Standard (International Window Cleaning Association).

E. OSHA 1910, Subpart D (Walking and Working Surfaces).

F. Appendix C to OSHA 1910 Subpart F (Personal Fall Arrest Systems).

1.5 SUBMITTALS

A. The Contractor shall submit to the Commissioner for approval, shop drawings and other material required to substantiate conformance with the requirements set forth on the Contract Drawings and these Specifications in accordance with the General Conditions, Contractor's Working Drawings, Design and Shop Drawings; and the submittal procedures of the DDC General Conditions.

B. Working Drawings shall include, but not be limited to, outline and dimensional drawings including detailed sections and materials specifications and as follows:

1. Layout drawings showing all structural shapes, sizes, and dimensions of complete fall protection system, including all components and accessories. Adjacent work of other trades to be shown on layout drawings.

2. Certifications, schedules, design calculations, detailed drawings, plans, elevations, and details of sections, connections and profiles required for all metal fabrications associated with the work.

3. Working Drawings and Calculations: The Contractor shall submit calculations for loadings signed and sealed by a Professional Engineer licensed to practice and registered in the State of New York.

4. Shop drawings to include installation and rigging instructions and all necessary Restrictive and Non-Restrictive Working Usage Notes and General Safety Notes.

C. No fabrication shall be started until Working Drawings and Shop Drawings have been approved by the Commissioner.

D. The following shall also be submitted:

1. Certified weld inspection reports.

E. Record Drawings: During progress of the work, an up to date set of drawings showing Field and Working Drawing modifications shall be kept. Immediately upon completion of work, Record Drawings showing the actual in-place installation of all work constructed and/or installed under this Section as specified in the General Conditions shall be provided. Drawings shall include all necessary plans, sections and details, with all reference dimensions and elevations required for complete Record Drawings of the work.

F. Operation Procedure

Submit an Operating Procedure and include all of the necessary elements in both pictorial and written form, to instruct employees in the safe use of the fall protection system. Ensure that the Operating Procedure contains at least the following elements:

1. Isometric or plan view drawing of the building's roof, including the building's name, address, and the date the Operating Procedure was prepared.

2. The drawing shall be legible and kept with the building's management office.

3. Identification of all anchorage points for personal fall arrest systems.

4. Identification of all personal fall protection requirements and, if applicable, procedures for securing equipment.

5. If applicable, identification of all dangerous areas on the roof by highlighting all of the "Danger Zones" on the drawings.

6. Identification of equipment limitations, load ratings, and special use conditions.

7. Provisions for pre-operational, operation and inspections.

8. Emergency and rescue procedures, and means of communications to be used during such procedures; and

9. Method(s) to be used to control employee exposure to falls while they are in the "Danger Zone."

10. Submit one copy of system Equipment Manual and Inspection Log Book, with "Initial Inspection – Certification for Use" and "Inspection Sign-Off" forms completed.

1.6 QUALITY ASSURANCE AND QUALIFICATIONS

A. Performance Criteria

1. Engineer all anchor components to provide adequate attachment to the building and suited to current vegetated roof care practices. Ensure compatibility with industry standard equipment.

2. Locate anchorages to suit suspension equipment that will be used on the building with respect to items such as reach, spacing, roof edge condition, and similar items.

3. Ensure all anchor components conform to proper engineering principles and have been designed by a Professional Engineer qualified in the design of FAE equipment, its application and safety requirements.

4. Engineer system fall arrest safety anchors and equipment supports to comply with the following structural requirements:

   a. Fall Arrest Safety Anchors: Engineered to a maximum fall arresting force of typically 0.8 kN when wearing a body harness with a safety factor of two without any permanent deformation and to 22.4 kN against fracture or detachment or 5000 LBS MIN. capacity at each roof anchor, whichever is greater.

b. Ensure capacity of primary support equipment is capable of sustaining without failure at least four times the maximum static working load applied or transmitted to the components, i.e. a 4 to 1 stability factor.

5. Manufacturer: Work of this Section to be executed by manufacturer specializing in the engineering, fabrication, and installation of fall protection systems having a minimum of three years documented experience

6. Loading and Safety Assurance: Work of this Section to meet the requirements of governing codes and jurisdiction and to comply with properly engineered loading and safety criteria for the intended use.

7. Welding to be executed by certified welders in accordance with AWS requirements.

B. Inspectors shall have the authority to reject any materials or work which does not meet the requirements of these Specifications.

C. Engineer of Members and Connections:

1. All details shown are typical. Similar details apply to similar conditions, unless otherwise shown or specified.

2. Each fabricator shall be responsible for calculations required to comply with performance criteria specified or contained in standard documents specified.

3. Complete calculations required to show compliance shall be prepared, signed and stamped with the seal of a Registered Professional Engineer, licensed to practice in the State of New York.

D. Shop Assembly:

1. All items shall be preassembled in the shop to the greatest extent possible so as to minimize assembly at the Site.

1.7 FIELD MEASUREMENTS

A. The Contractor shall verify all dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of work.

B. The Contractor shall review the Contract Drawings and any discrepancies shall be reported to the Commissioner for clarification prior to start of fabrication.

1.8 GREEN BUILDING GENERAL REQUIREMENTS

A. Metal in this section shall contain recycled content as available.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural steel shapes shall be fabricated in accordance with the details shown on the Contract Drawings and shall conform to the requirements of Section 051200 - Structural Steel, and ASTM A 36, unless otherwise indicated.

B. Cable: 8 mm diameter, Type 2205 Duplex stainless steel with minimum breaking strength of 87 kN, complete with permanently swedged cable ends.

C. Harness: Manufacturer's standard full body harness and lanyard complete with shock absorber.

D. Complete Horizontal Cable Lifeline Fall Protection System by:

1. Pro-Bel Group Limited
65 Sunray Street
Whitby, Ontario
L1N 8Y3
Toll Free: (800) 461-0575
Tel: (905) 427-0616
Fax: (905) 427-2545

2. Tractel Inc. 11-51 44th Road
Long Island City, NY 11101 Tel. (781) 828 7600

3. Or Approved Equal

PART 3 EXECUTION

3.1 INSPECTION

A. The Contractor shall examine the alignment of the substrate and conditions under which the work is to be performed and notify the Commissioner in writing of unsatisfactory conditions. Do not proceed with installation work until unsatisfactory conditions have been corrected in a manner acceptable to the Commissioner. Commencement of work will imply acceptance of prepared work.

B. Verify Site Dimensions

3.2 FABRICATION

A. Fabrication of steel shall be in accordance with the Specification for the Design Fabrication and Erection of Structural Steel for Building of the AISC.

B. Holes for bolts and screws shall be drilled. Fastenings shall be concealed where practicable. Joints exposed to the weather shall be formed to exclude water.

3.3 INSTALLATION

A. Steel Anchors & Posts shall be erected square, plumb and true, accurately fitted, adequately anchored in place, set at proper elevations and positions.

B. Install equipment in accordance with approved shop drawings and manufacturer's recommendations.

C. Coordinate installation with work of related trades.

D. Install all work true, level, tightly fitted, and flush with adjacent surfaces as required.

E. Precast Concrete Roof Slabs shall be designed to receive safety tie back anchors and shall have adequate bearing surface to ensure proper welded or bolted connection. Coordinate all work with Precast Concrete Manufacturer & Installer.

3.4 ERECTION

A. Steel Anchors & Posts shall be erected level and plumb within allowable tolerances, without damage to shape or finish.

3.5 FINAL ADJUSTING & INSPECTION

A. Adjust and leave equipment in proper working order.

B. Complete "Initial Inspection - Certification for Use" form included in Equipment Manual and Inspection Log Book.

3.6 TESTING

A. Job Site Tests: Submit a comprehensive Method Statement detailing all tests to be conducted at the job site prior to use, but at minimum shall comply with the following basic tests:

1. Load test

3.7 WARRANTY

A. Provide manufacturer's warranty executed by manufacturer or their company's authorized agent for five years against defects in materials and installation.

END OF SECTION

SECTION 114800

ATHLETIC AND RECREATIONAL EQUIPMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish and install athletic and recreational equipment as shown on the Drawings and as specified herein.

1.3 SUBMITTALS

A. Manufacturer's cut sheets and specifications data, as well as layout drawings showing the complete system layout.

B. Operations and Maintenance Manual.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Detailed Specification 018113– LEED Certification Requirements). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Detailed Specification 01301 – LEED Certification Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material

listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. For wood products, indication (Y/N) of whether the supplied product(s) are certified by the Forest Stewardship Council (FSC).

7. Documentation that all composite wood and agrifiber products do not contain added urea-formaldehyde.

8. Chain of custody certification to document FSC-certification, if applicable.

1.4 QUALITY ASSURANCE AND QUALIFICATIONS

A. Equipment and components must be obtained from same supplier.

B. Installer Qualifications: The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

C. Manufacturer Qualifications: The manufacturer providing the material or equipment specified in this section must, for the past five (5) years, have been regularly engaged in the manufacture of material or equipment similar in type to that required for this Project. Such similar material or equipment provided by the manufacturer must have been in satisfactory service for not less than five (5) years.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Athletic and recreational equipment shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with DDC General Conditions.

B. Athletic and recreational equipment materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the DDC General Conditions.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of DDC General Conditions.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide the following golf equipment or approved equivalent from one of the following manufacturers:

1. Range Servant
2. Oxland
3. Witek

Item No.	Qty	Description	By	Remarks
07-01	1	Ball Dispenser #1	Contractor	-43,000 Ball Capacity -dispense 3 bucket sizes of any ball amt. -stainless steel chk plate finish -option for tokens, cash, range cards, credit cards
07-02	1	Ball Dispenser #2	Contractor	-19,000 Ball Capacity -dispense 3 bucket sizes of any ball amt. -stainless steel chk plate finish -option for tokens, cash, range cards, credit cards
07-04	1	Ball Washer	Contractor	-min 20,000 balls/hr -galvanized steel construction -0.5 hp direct drive motor -1,000 ball capacity pre-sorting bin
07-05	1	Ball Elevator	Contractor	-stainless steel finish -min 500 balls/min -direct drive motor -photo-sensor w/ auto shut down
07-06	1	Disp. Connector	Contractor	
07-07	Refer Dwgs	Tee Box Ball Collection Impact Netting	Contractor	-black resin dye polyester -5/8"-3/4" mesh size -cage configuration, Raschel knotless const., dye treated -UV resistant

B. Vertical Impact Netting System: Provide Polyester Impact Netting System at Tee Boxes partitions or approved equivalent from one of the following manufacturers. Color: Black.

1. Redden Nets
2. Action Sports Netting
3. Gourock

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide on-site installation by trained and experienced installers.

3.2 INSTRUCTION

A. Provide instruction for City of New York's maintenance personnel.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective work where possible to eliminate functional and visual defects; where not possible to repair, replace athletic and recreational equipment.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that athletic and recreational equipment is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 122413

WINDOW SHADES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the window shades as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Manually operated window shades.

2. Field measurements of as-built conditions.

3. Accessories and hardware required for complete installation and operation.

1.3 QUALITY ASSURANCE

A. Provide assemblies which are complete assemblies produced by one manufacturer, including hardware, accessory items, mounting brackets, and fastenings.

B. Provide materials in colors as selected by the Commissioner from manufacturer's standard colors.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Submit floor layout and elevations, indicating location of all window treatments, mechanism details, type and size of each unit, type and location of controls. Shop drawings must also show seaming of shade fabric. Submit shop drawings showing details of installation and relation to adjoining construction and conditions.

C. Samples: Submit full size sample of each shade type for Commissioner's acceptance.

D. Mock-Up

1. Install each type of shade assembly on one complete column bay for Commissioner's acceptance of installation details, workmanship and operation.

2. Approved mock-up shall be used as the standard for installation of work under this Section, and no further installation work shall proceed before Commissioner's acceptance of the mock-up.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 LEED PERFORMANCE REQUIREMENTS

A. Window shades shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Wire mesh partitions materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.6 WARRANTY

A. Manufacturer's standard non-depreciating 25-year limited warranty covering all hardware, chains and shade cloth.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect shades from damage, soiling and deterioration during transit, storage and handling to, until City of New York's acceptance.

PART 2 PRODUCTS

2.1 MANUALLY OPERATED SHADES

A. Provide manually operated shade system equal to "MechoShade/5 System," made by the MechoShade Corp. or equal made by Sol-R-Veil Inc., Draper, or approved equal conforming to standards specified herein.

B. Shade system shall be pre-engineered overrunning clutch design that disengages to 90% during the raising and lowering of the shade. The brake can stand a pull force of 40 lb. in the stop position. Requires no adjustment. Self-lubricating hub on to which the brake system is mounted includes an articulated brake assembly which assures smooth, non-jerky operation in raising and lowering the shades. System shall include the following components:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and remounting of the shade bands without having to remove the shade tube, drive, or operating support brackets.

3. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

4. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

5. Provide shade hardware system that allow for operation of multiple shade bands (multi-banded shades) by a single chain operator. Connectors shall be offset to assure alignment from the first to the last shade band.

6. Provide shade hardware constructed of minimum 1/8" thick plated steel or heavier as required to support 150% of the full weight of each shade.

7. Drive Bracket / Brake Assembly:

   a. Mecho Shade Drive Bracket M5 or equal by other manufacturers noted herein.
   b. Drive Chain: #10 qualified stainless steel chain rated to 90 lb.
   c. Minimum Breaking Strength: Nickel plate chain shall not be accepted.

C. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be the same, for all shades within one room.

2. Shade Band and Shade Roller Attachment:

   a. Provide extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without deflection. Provide for positive mechanical engagement with drive/brake mechanism.
   b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable/replaceable with a snap-on/snap-off spline mounting without having to remove shade roller from shade brackets.
   c. Mounting spline shall not require use of adhesives, adhesive tapes, staples and/or rivets.

2.2 SHADE CLOTH

A. Shade cloth shall be from group indicated below, color and optical properties as selected by the Engineer made by Mecho-Shade or equal by other manufacturers noted herein.

1. BL-01: Roller Shade

   a. Location: Perimeter Glazing
   b. Fabric: Bogota Low E 0500, 5% open, 2 by 2 dense basket weave pattern.
   c. Color: As selected by Commissioner.

2. BL-02: Roller Shade

   a. Location: Perimeter Glazing
   b. Fabric: Bogota Low E 0500, 3% open.
   c. Color: As selected by Commissioner.

3. BL-03: Roller Shade

   a. Location: Office
   b. Fabric: Mechoshade TBC

B. OPTION: Aluminum fabric, as directed by the Commissioner.

2.3 FABRICATION

A. The shade and the fabric shall hang flat without buckling or distortion. The edge, when trimmed, shall hang straight without curling or raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than +/- 1/8" in either direction due to warp distortion or weave design. Shades shall fill window openings from head to sill and jamb to jamb.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where window treatments are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION: GENERAL

A. Coordinate with the work of other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the indicated design and the installation recommendations of the manufacturer as approved by the Commissioner.

C. Upon completion of the installation, put all components through at least ten (10) complete cycles of operation, adjusting as necessary to achieve optimum operation.

3.3 INSTALLATION OF MANUAL ROLLER SHADES

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions and located so shade band is not closer than 2" to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturers written instructions.

3.4 PROTECTION AND CLEANING

A. Protect installed units to ensure proper operating condition, without damage or blemishes. Repair or replace damaged units as directed by the Commissioner.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 124813

FLOOR MATS AND FRAMES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the floor mats and frames as shown on the drawings and/or specified herein.

1.3 RELATED SECTIONS

A. Concrete recess – Section 033000.

1.4 QUALITY ASSURANCE

A. Manufacturer: Except as otherwise indicated, provide entrance mats and accessories by a single manufacturer for entire project.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for entrance mat. Include methods of installation for each type of substrate.

B. Samples: Submit samples for each type and color of exposed entrance mat, frames and accessories required. Provide 12" square samples of mat materials and 12" lengths of frame members.

C. Maintenance Data: Submit manufacturer's printed instructions for cleaning, drying, maintaining and rehandling of removable entrance mat units.

D. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor's or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).
   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Division 01 LEED Requirements Section). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification Section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Floor mats shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 01 LEED Requirements Section.

B. Floor mats materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Division 01 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Division 01 VOC Limits Section where applicable.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MAT AND FRAME

A. WM-01: Walk-Off Mat, recessed.

1. Product: "Al-Track G Series" G285, as manufactured by AMARCO (American Mat and Rubber Company), or equal by Mats Inc., or approved equal.

2. Materials: Aluminum with carpet insert; color as selected by Commissioner.

B. Frame: Recessed angle frame, "ATF-1" by AMARCO, 6063-T52 aluminum alloy extrusions, clear anodized finish, or equal by Mats Inc., or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where floor mats and frames are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install cast-in-place mat frames integrally with principal pour of concrete floor system. Install angle mat frames into prepared block out. Install mat frames in accordance with the manufacturer's installation instructions. Locate, align and level frame members accurately.

B. Protection: Upon completion of frame installation and concrete work, provide temporary filler of plywood or fiberboard in mat recesses, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project reaches substantial completion.

C. Delay installation of mats until work on the project reaches substantial completion.

D. Lay mats in frames to fit properly and be centered in the recess; do not adhere.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 129300

SITE FURNISHINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Bike Racks

1.3 RELATED SECTIONS

A.	Sustainability Requirements	- Section 013010
B.	Cast-In-Place Concrete	– Section 033000
C.	Miscellaneous Metals	- Section 055000
D.	Ornamental Metals	- Section 057000

1.4 QUALITY ASSURANCE AND QUALIFICATIONS

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Fabrication Standards: Provide each site furnishing as a complete unit produced by a single fabricator including fittings, accessories, bases and anchorage devices.

C. Construct and ship to Site in one piece.

D. Construction tolerances:

1. Plumb: within 1/8" from plumb

2. Level: within 1/8" from level

3. Alignments: within 1/4" from line of alignment

1.5 SUBMITTALS

A. Product Data

1. For each type of product.

B. Shop Drawings: Submit drawings showing locations, layouts, materials, thickness, finishes, dimensions, construction, relation to adjoining construction, erection details, profiles, jointing, anchor details and all other details to fully illustrate the work in this Section.

C. Samples: For each product and for each color and texture specified.

D. Samples for Verification: For each type of exposed finish, not less than 6-inch long linear components and 4-inch square sheet components.

1. Bike rack samples

a. 3 samples showing non-directional finish in differing grits:
1). Non-directional satin finish
2). Two other non-directional finishes with varying grit levels
b. Full size sample of bike rack. Welds shall be ground smooth and sample shall show chosen finish.

2. Product Schedule: For Site Furnishing. Use same designations indicated on Drawings.

E. Closeout Submittal.

1. Maintenance Data: For site furnishings to include in maintenance manuals.

F. LEED Submittal Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and materials-only cost.

b. The percentages (by weight) of post-consumer and /or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufacturered.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g. recycled content, VOC content).

3. For products and materials in LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed on the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

PART 2 PRODUCTS

2.1 BICYCLE RACK

A. Products: Subject to compliance with requirements, provide the following:

1. Custom bike rack to meet the dimensions and requirements of the detail drawings.

a. Material – 316 Stainless steel pipe and plate. Provide samples for approval as listed herein.
b. The top of the pipes shall have welded caps. All welds shall be ground smooth. The finish shall be as chosen from the approved samples.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where bicycle racks are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

C. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed

D. Install site furnishings level, plumb, true, and securely anchor at locations indicated on Drawings.

END OF SECTION

SECTION 133123

TENSIONED FABRIC STRUCTURES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish and install tensioned fabric structures as shown on the drawings and specified herein.

1.3 RELATED SPECIFICATIONS

A. Cast-in-place concrete – Section 033000.

B. Architecturally exposed structural steel – Section 051213.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM A416 – Standard Specification for Steel Strand Uncoated Seven-Wire for Prestressed Concrete.

2. ASTM A586 – Standard Specification for Zinc-Coated Parallel and Helical Steel Wire Structural Strand.

3. ASTM A603 – Standard Specification for Zinc-Coated Steel Structural Wire Rope

4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

5. ASTM E108 – Standard Test Methods of fire Tests of Roof Coverings.

6. ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 deg. C.

1.5 PERFORMANCE REQUIREMENTS

A. Comply with the New York City Building Code 1968 edition with amendments through 2007, including snow loading (Section 27-561), wind loading (Reference Section RS 9-5), and seismic loading (Reference Section RS 9-6.

B. The Contractor shall engineer, fabricate and install custom tensioned fabric and steel support structures in accordance with the design intent as indicated on the Drawings and as specified herein. Any changes required to the design requires approval by the Commissioner prior to commencement of construction.

C. Perform structural analysis of tensioned fabric and steel support structures by professional Engineer with experience in membrane structures using large displacement finite element techniques. Utilize this analysis to prepare shop drawings.

D. Ensure structural integrity is maintained for life-safety issues in the event of a tear propagating in the fabric.

E. Engineer tensioned fabric structures to ensure tensioned fabric has a smooth uniform surface with even curved edges without wrinkling, cuts, abrasions, stains, marks, or surface defects.

1.6 QUALITY ASSURANCE

A. Qualifications

1. The Contractor shall have at least three (3) years' experience in fabrication and installations similar to the work specified herein.

2. A Contractor with tension fabric structure experience shall submit a list of completed within the last three (3) years. For each project, the Contractor shall include with this submittal, at a minimum: (1) name of client contact, address, and telephone number; (2) location of project; (3) contract value; and (4) scheduled completion date and actual completion date for the project.

B. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in other construction; coordinate delivery with other work to avoid delay.

C. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to ensure proper operation and servicing of accessory units.

1.7 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, catalogue cuts and installation instructions for each component of the tensioned fabric structures.

B. Shop Drawings:

1. Submit shop drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data. Include placing drawings for steel members (posts, poles, cables, etc.) showing size and gauge designations, number, type, location and spacing. Indicate supplemental bracing, splices, accessories and details as may be required for proper installation.

2. Shop drawing shall define the complete structure, except interface geometry determination and definitions, coordination between fabric and structural supports,

reaction loads imposed by fabric roof, connections, details, and interfaces to the base foundation support.

C. Engineering Data:

1. Submit Engineering Data drawings to the Commissioner for review. The manufacturer is responsible for the structural design and supports for the tensioned fabric structures, and must show his proposed system and how the Performance Criteria is accommodated on these drawings.

2. These drawings must show all load conditions and design calculations relative to connections, fastening devices and anchorage, as well as size and gauge of members. Calculations and drawings must be prepared, signed and sealed by a Professional Engineer licensed in the State of New York.

D. Quality Assurance Submittals: Submit the following:

1. Qualifications: Proof of manufacturer, installer, and welder qualifications.

2. Structural design calculations.

3. Manufacturer's installation instructions for framing members and fabric.

E. Samples: Submit samples of materials that demonstrate product type, color and finish.

1. Submit 12 inches x 12 inches sample of fabric.

2. Submit 12 inches x 12 inches sample showing reinforcement.

F. Operating and Maintenance Instructions

1. Instructions for fabric repair.

2. Instructions for cleaning fabric.

1.8 PRODUCT HANDLING

A. Deliver accessories to the site ready for use in the manufacturer's original and unopened containers and packaging, bearing labels as to type or material, manufacturer's name and brand name. Delivered materials shall be identical to approved samples.

1.9 WARRANTY

A. Workmanship: 1 year.

B. Fabric: Manufacturers standard fabric warranty, 10 years minimum.

1.10 GREEN BUILDING GENERAL REQUIREMENTS

A. Membrane roofing shall have a Solar Reflective Index (SRI) equal to or greater than 29 when tested in accordance with ASTM E1980.

B. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of DDC General Conditions, where applicable.

PART 2 PRODUCTS

2.1 ENGINEERED TENSIONED FABRIC STRUCTURES

A. FB-01: Tensioned Fabric Canopy System

1. Structural Fabric: "Sheerfill II-HT Architectural Membrane" by Saints-Gobain Performance Plastics, Serge Ferrari, Universal Fabric Structures or approved equal.

2. Cables and End Fittings: All cables shall be Class A zinc coated. Cables in contact with fabric shall be PVC coated.

   a. Structural Wire Ropes Cables: ASTM A 603
   b. Structural Strand Cables: ASTM A 586
   c. 7-Wire Prestressing Strand: ASTM A 416, Grade 270

3. Steel Supports: Comply with Section 051213 – Architecturally Exposed Structural Steel.

4. Provide tensioned fabric canopy system as manufactured by one of the following:

   a. Saint-Gobain Performance Plastic, 701 Daniel Webstser Highway, Merrimack, NH 03054, (603) 424-9000
   b. FabricArchitect.com, Fairfield, NJ; contact Sam Armijos, 973.244.5871
   c. Architect Landrell Associates, Ltd., Chepstow, UK; contact Lance Rowell, +44 (0) 1291 638 200
   d. Birdair Inc., Amherst, NY; contact William Barden, 716- 633-9500
   e. Or approved equal.

5. All fabric, fittings, posts, poles, cables and connections shall be provided by the manufacturer as a complete engineered system.

6. System must comply with load requirements of the New York City Building Code

7. The fabric structure must:

   a. Have a base fabric which passes as noncombustible in accordance with ASTM E 136 (incombustibility of Substrate).
   b. Have resistance to exterior fire exposure consistent with the overall construction classification in accordance with ASTM E 108 (Fire Resistance of Coverings).
   c. Have a resistance to spread of flame and limit smoke generation for interior finishes consistent with classification of the structure in accordance with ASTM E 84 (Surface Burning Characteristics).

8. Provide calculations for all system elements signed and sealed by a Professional Engineer licensed in the State of New York. Calculations shall include all foundation reactions.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where tensioned fabric roof system is to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.2 INSTALLATION

A. Install system in strict accordance with approved shop and engineering drawings and manufacturer's instructions.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 210517

SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal system
3. Sleeve-seal fittings.
4. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

T6-094

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metraflex Company (The).
   2. Pipeline Seal and Insulator, Inc.
   3. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   1. Presealed Systems.

   2. Thruwall

   3. Linkseal

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 : Cast-iron wall sleeves.
b. Piping NPS 6 and Larger: Cast-iron wall sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6 : Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 210517

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 210518

ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With [polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 210548

VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restraining braces.

B. Related Work Specified Elsewhere:

1. Section 01 81 13 "Sustainable Design Requirements"
2. Section 01 74 19 "Construction Waste Management"
3. Section 01 81 13 "Sustainable Design Requirements"
4. Section 01 81 14 "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings"

C. LEED General Requirements

1. This Project is targeting a level of Certification under USGBC's LEED Green Building Rating System for New Construction (2009). The contractor, subcontractor, vendors, material suppliers and manufacturers performing work on this Project shall ensure that the requirements related to these goals, as defined in the sections below, are implemented fully.
2. Substitutions, or other changes to the work, proposed by the contractor, subcontractor, vendors, material suppliers and manufacturers performing work on this Project shall not be allowed if such changes to this specification section may compromise the attainment of any points under any credits on the Project's LEED Checklist. The Project's LEED Checklist is available upon request.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: C.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
   a. Component Importance Factor: 1.25.
   b. Component Response Modification Factor: 5.0.
   c. Component Amplification Factor: 4.5.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 23.2 percent.
4. Design Spectral Response Acceleration at 1-Second Period: 9.7 percent.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
   b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the professional engineer, licensed in New York, responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Seismic-Restraint Details:
   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
   c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Welding certificates.

D. Qualification Data: For professional engineer and testing agency.

E. Green Building Submittal Requirements:

1. LEED Building Submittal Requirements: The Contractor or subcontractor shall submit the following LEED Building certification items in accordance with Section 018113 Sustainable Design Requirements:

2.

a. GREEN BUILDING MATERIALS CERTIFICATION FORM and/or VOC REPORTING FORM.
b. Material costs breakdowns.
c. Letters of Certification, Product Cut Sheet, or other items to support the information as requested by the Commissioner.
d. Material Safety Data Sheets, for all applicable products. Applicable products include, but are not limited to adhesives, sealants, carpets, paints, and coatings. Material Safety Data Sheets shall include the Volatile Organic Compound (VOC) of products submitted (If an MSDS does not include a product's VOC limits, then product data sheets, manufacturer literature, or a letter of certification from the manufacturer can be submitted in addition to the MSDS to indicate the VOC limits).
e. The LEED Building Submittal Information shall be assembled into one package per specification section (or per subcontractor), and sent to the Commissioner for review.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. Connecticut Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.

2. Connecticut Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

I. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:
1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

B. Piping Restraints:
1. Comply with requirements in MSS SP-127 and NFPA 13.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 21 Section "Wet-Pipe Fire-Suppression Sprinklers" "Dry-Pipe Fire-Suppression Sprinklers" for piping flexible connections.

END OF SECTION 210548

This Page Intentionally Left Blank

SECTION 210553

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.

2. Letter Color: Red.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; pipe size; and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

E. Pipe-Label Colors:

1. Background Color: Red.
2. Letter Color: White.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain beaded chain or S-hook.
3. Valve-Tag Color: Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 LABEL INSTALLATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install or permanently fasten labels on each major item of mechanical equipment.

D. Locate equipment labels where accessible and visible.

E. Piping Color-Coding: Painting of piping is specified in other sections.

F. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

G. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:

a. Fire-Suppression Standpipe: 2 inches, round.
b. Wet-Pipe Sprinkler System: 2 inches, round.
c. Dry-Pipe Sprinkler System: 2 inches, round.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 210553

SECTION 211313

WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Sections:
1. Section 211316 "Dry-Pipe Sprinkler Systems" for dry-pipe sprinkler piping.
2. Section 230533 "Heat Tracing for HVAC Piping."

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.

C. Engineering Submittal: Provide sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated. A new fire hydrant shall be obtain by this contractor.

D. Sprinkler system design shall be approved by the Commissioner.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   e. Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 225 sq. ft..
   b. Storage Areas: 130 sq. ft..
   c. Mechanical Equipment Rooms: 130 sq. ft..
   d. Electrical Equipment Rooms: 130 sq. ft..
   e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Engineering Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Submit all information to the Commissioner for review and approval prior to the start of work.

E. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.

F. Qualification Data: For qualified Installer and professional engineer.

G. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

H. Welding certificates.

I. Fire-hydrant flow test report.

J. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

K. Field quality-control reports.

L. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include fabricating, and installing sprinkler systems and providing professional engineering. Base calculations on results of fire-hydrant flow test.

    a. Engineering Responsibility: Preparation of working plans, any revised calculations, and field test reports by a qualified professional engineer.
    b. Submit all information to the Commissioner for review and approval prior to the start of work.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

D. Cast-Iron Flanges: ASME 16.1, Class 125.

E. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

F. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

G. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

H. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Victaulic Company.

   b. Grinnell

   c. Rasco

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
3. Minimum Pressure Rating for High-Pressure Piping: 250 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Victaulic Company.

2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fivalco Inc.
   b. Global Safety Products, Inc.
   c. Milwaukee Valve Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Global Safety Products, Inc.
   c. NIBCO INC.
   d. Tyco Fire & Building Products LP.
   e. Victaulic Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.

5. Style: Lug or wafer.
6. End Connections: Grooved.

E. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. Crane Co.; Crane Valve Group.
   c. Fire-End & Croker Corporation.
   d. Globe Fire Sprinkler Corporation.
   e. Potter Roemer.
   f. Reliable Automatic Sprinkler Co., Inc.
   g. Tyco Fire & Building Products LP.
   h. Victaulic Company.
   i. Viking Corporation.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. United Brass Works, Inc.

2. Standard: UL 262.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

G. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Clow Valve Company; a division of McWane, Inc.
   b. Crane Co.; Crane Valve Group.
   c. Hammond Valve.
   d. Tyco Fire & Building Products LP.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.

4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

H. Indicator Posts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Clow Valve Company; a division of McWane, Inc.
   b. Crane Co.; Crane Valve Group; Stockham Division.
   c. NIBCO INC.
   d. Tyco Fire & Building Products LP.

2. Standard: UL 789.
3. Type: Horizontal for wall mounting.
4. Body Material: Cast iron with extension rod and locking device.
5. Operation: Hand wheel.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire Protection Products, Inc.
   b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anvil International, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Fire-End & Croker Corporation.
   d. NIBCO INC.
   e. Potter Roemer.
   f. Tyco Fire & Building Products LP.
   g. Victaulic Company.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

    a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
    b. High-Pressure Piping Specialty Valves: 250 psig minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Reliable Automatic Sprinkler Co., Inc.
    b. Tyco Fire & Building Products LP.
    c. Victaulic Company.
    d. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Reliable Automatic Sprinkler Co., Inc.
    b. Tyco Fire & Building Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Elkhart Brass Mfg. Company, Inc.
    b. Fire-End & Croker Corporation.
    c. Tyco Fire & Building Products LP.
    d. Potter Roemer.

2. Standard: UL 405.
3. Type: Exposed, projecting, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, wall type.
9. Outlet: Back, with pipe threads.
10. Number of Inlets: Two.
11. Escutcheon Plate Marking: Similar to " AUTO SPKR."
12. Finish: to be coordinated with Commissioner.
13. Outlet Size: NPS 6.

B. Flush-Type, Fire-Department Connection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkhart Brass Mfg. Company, Inc.
   b. Guardian Fire Equipment, Inc.
   c. Potter Roemer.

2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Outlet Location: Bottom.
13. Escutcheon Plate Marking: Similar to " AUTO SPKR."
14. Finish: to be coordinated with Commissioner.
15. Outlet Size: NPS 6.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Tyco Fire & Building Products LP.

c. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Company, Inc.
   b. Fire-End & Croker Corporation.
   c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Tyco Fire & Building Products LP.
   b. Victaulic Company.

c. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. FlexHead Industries, Inc.
   b. Victaulic

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.9 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Open Sprinklers with Heat-Responsive Element Removed: UL 199.

1. Characteristics:

   a. Nominal 1/2-inch Orifice: With Discharge Coefficient K between 5.3 and 5.8.
   b. Nominal 17/32-inch Orifice: With Discharge Coefficient K between 7.4 and 8.2 .

E. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

F. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

H. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Tyco Fire & Building Products LP.
   b. Victaulic Company.
   c. Viking Corporation.

2. Standard: UL 753.

3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10-inch diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ADT Security Services, Inc.
   b. Potter Electric Signal Company.
   c. System Sensor; a Honeywell company.
   d. Viking Corporation.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Potter Electric Signal Company.
   b. System Sensor; a Honeywell company.
   c. Tyco Fire & Building Products LP.
   d. Viking Corporation.

2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Potter Electric Signal Company.
   b. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.

4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

F. Indicator-Post Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Potter Electric Signal Company.
   b. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.11 MANUAL CONTROL STATIONS

A. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.12 CONTROL PANELS

A. Description: Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves. Panels contain power supply; battery charger; standby batteries; field-wiring terminal strip; electrically supervised solenoid valves and polarized fire-alarm bell; lamp test facility; single-pole, double-throw auxiliary alarm contacts; and rectifier.

1. Panels: UL listed and FM approved when used with thermal detectors and Class A detector circuit wiring. Electrical characteristics are 120-V ac, 60 Hz, with 24-V dc rechargeable batteries.
2. Manual Control Stations: Electric operation, metal enclosure, labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.
3. Manual Control Stations: Hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.13 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Provide results to the Commissioner for review and approval prior to the start of work.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping.

B. Install shutoff valve, pressure gage, drain, and other accessories indicated at connection to water-service piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Commissioner before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 230533 "Heat Tracing for HVAC Piping."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

O. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

P. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

Q. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
3. Deluge Valves: Install in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire-department connections.

B. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain specialty valves.

3.12 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Concealed sprinklers.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

SECTION 211316

DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinkler specialty pipe fittings.
5. Sprinklers.
6. Alarm devices.
7. Manual control stations.
8. Control panels.
9. Pressure gages.

B. Related Sections:

1. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Sprinkler system design shall be approved by the Commissioner.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   e. Office and Public Areas: Light Hazard.
3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1950-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1950-sq. ft. area.
4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler: per NFPA 13

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation, where contractor originating deviation from contract documents is desired. Adjusted calculations shall be required for all work of this type.

1.7 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Domestic water piping.
   2. Compressed air piping.
   3. HVAC hydronic piping.
   4. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.

B. Qualification Data: For qualified Installer and professional engineer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Submit all information to the Commissioner for review and approval prior to the start of work.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.10 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include fabricating, and installing sprinkler systems and providing professional engineering services. Base any revised calculations on results of fire-hydrant flow test.
   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer. Submit all information to the Commissioner for review and approval prior to the start of work.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.11 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Galvanized, Steel Couplings: ASTM A 865, threaded.

E. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME B16.1, Class 125.

H. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Shurjoint Piping Products.

I. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International, Inc.
    b. Tyco Fire & Building Products LP.
    c. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron and Class 300, Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 LISTED FIRE-PROTECTION VALVES

A. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

2.5 TRIM AND DRAIN VALVES

A. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

    a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
    b. High-Pressure Piping Specialty Valves: 250 psig minimum.

3. Body Material: Cast or ductile iron.

4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Dry-Pipe Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 260
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Reliable Automatic Sprinkler Co., Inc.
      2) Tyco Fire & Building Products LP.
      3) Victaulic Company.
      4) Viking Corporation.

   b. Standard: UL 260.
   c. Type: Automatic device to maintain minimum air pressure in piping.
   d. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

6. Air Compressor:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Gast Manufacturing Inc.
      2) Viking Corporation.

   b. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
   c. Motor Horsepower: Fractional.
   d. Power: 120-V ac, 60 Hz, single phase.

2.7 SPRINKLERS

A. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

2.8 ALARM DEVICES

A. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Commissioner before deviating from approved working plans.

B. Piping Standard: Comply with requirements in NFPA 13 for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or to outside building.

K. Connect compressed-air supply to dry-pipe sprinkler piping.

L. Connect air compressor to the following piping and wiring:

1. Pressure gages and controls.
2. Electrical power system.
3. Fire-alarm devices, including low-pressure alarm.

M. Install alarm devices in piping systems.

N. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13 for hanger materials.

O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

P. Drain dry-pipe sprinkler piping.

Q. Pressurize and check dry-pipe sprinkler system piping and air-pressure maintenance devices air compressors.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

K. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

M. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.

2. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

   a. Install air compressor and compressed-air supply piping.
   b. Air-Pressure Maintenance Device: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer; pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.
   c. Install compressed-air supply piping from building's compressed-air piping system.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.6 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

A. Standard-pressure, dry-pipe sprinkler system, NPS 6 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

A. Section 211313 "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.

END OF SECTION 211316

This Page Intentionally Left Blank

SECTION 213113 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Vertical In-line fire pumps.
   2. Fire-pump accessories and specialties.
   3. Flowmeter systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.

   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of fire pump, from manufacturer.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 20.

B. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Pump manufacturer shall be ISO 9001 certified.

2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit, concrete, 12" high minimum.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.3 IN-LINE FIRE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. A-C Fire Pump; a Xylem brand.
2. Peerless Pump Company.
3. Pentair Pump Group.

B. Pump:

1. Standard: UL 448, for in-line pumps for fire service.
2. Casing: Cast iron, with ASME B16.1 pipe-flange connections.
3. Impeller: Cast bronze, ASTM B584 – Alloy 875 enclosed type statically and dynamically balanced, and keyed to shaft. Suction and discharge flanges shall be located on a common centerline, 180 degrees apart, for mounting in the pipeline. The standard pipe flanges shall be drilled for 125# per ANSI B16.1 standard.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.

a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.

b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

6. Mounting: Pump and driver shaft is a single-staged, close-coupled, vertical in-line design, in cast iron bronze fitted construction with packing bearing directly on a stainless steel or a bronze shaft sleeve. The pump internals shall be capable of being serviced without disturbing the piping connection. Motor and pump rotating assembly shall be removable from top without removing the pump casing from the piping.

7. The pump shall be rated for a minimum of 175 PSIG working pressure.

8. The pump shall have split bronze packing glands.

9. The stuffing box shall be furnished with impregnated yarn packing, lantern ring and a catch basin for piping leakage to drain.

10. A rubber slinger will be installed on the shaft before the motor to prevent the passage of liquid to the motor.

11. The pump shall have gauge tappings at the suction and discharge nozzles as well as vent and drain tappings at the top and bottom.

C. Coupling: None or rigid.

D. Driver:

1. Standard: UL 1004A.
2. Type: Electric motor; NEMA MG 1, JP frame type.

E. Capacities and Characteristics:

1. Rated Capacity: 300 gpm.
2. Total Rated Head: 85 psig.
3. Inlet Flange: Class 125.
4. Outlet Flange: Class 125.
5. Suction Head Available at Pump: 20 psig.
6. Motor Horsepower: 25 hp.
7. Motor Speed: 3550 rpm.
8. Electrical Characteristics:

a. Volts: 460 V.
b. Phase: Three.
c. Hertz: 60.

2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Gauges: 3-1/2" dial suction and discharge gauges.

B. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

C. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

D. Relief Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. CLA-VAL Automatic Control Valves.
b. Kunkle Valve.
c. Watts; a Watts Water Technologies company.

2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

E. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

F. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

G. Discharge Cone: Closed type.

H. Hose Valve Manifold Assembly:

1. Standard: Comply with requirements in NFPA 20.
2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: UL 1726.
5. Manifold:

a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe, with ends threaded according to ASME B1.20.1.
d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
e. Escutcheon Plate: Brass or bronze; rectangular.
f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
g. Exposed Parts Finish: Polished brass.
h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.5 FLOWMETER SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following,or approved equal:

1. Emerson Process Management; Rosemount Division.

2. Fire Research Corp.
3. Gerand Engineering Co.

B. Description: UL-listed or FM-Approved, fire-pump flowmeter system able to indicate flow to not less than 175 percent of fire-pump rated capacity.

C. Pressure Rating: 175 psig minimum.

D. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.

E. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter. Include bracket or device for wall mounting.

1. Tubing Package: NPS 1/8 or NPS 1/4 soft copper tubing with copper or brass fittings and valves.

2.6 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.7 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting:

1. Install fire pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation devices specified in Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."

C. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

D. Support piping and pumps separately, so weight of piping does not rest on pumps.

E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Section 211313 "Wet-Pipe Sprinkler Systems."

F. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in Section 211313 "Wet-Pipe Sprinkler Systems."

G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

H. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

I. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

J. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

A. Align end-suction pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
2. Test according to NFPA 20 for acceptance and performance testing.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 213113

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of common motor requirements for plumbing equipment work required for this Project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of common motor requirement for plumbing equipment specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to Division 1 Specification Sections.

B. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions procedures.

1.5 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.3 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.4 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. See "Energy Considerations" Article in the Evaluations for discussion of motor efficiencies.

C. Efficiency: Energy efficient, as defined in NEMA MG 1.

D. Service Factor: 1.15.

E. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

F. Multispeed Motors: Separate winding for each speed.

G. Rotor: Random-wound, squirrel cage.

H. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

I. Temperature Rise: Match insulation rating.

J. Insulation: Class F.

K. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

L. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.6 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Sleeves.

2. Stack-sleeve fittings.

3. Sleeve-seal systems.

4. Sleeve-seal fittings.

5. Grout.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of sleeves and sleeve seals for plumbing piping work required for this Project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of sleeves and sleeve seals for plumbing piping specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable.

D. ASME Compliance: Comply with ASME B31.9 "Building Service Piping" for piping materials and installation.

1.4 ACTION SUBMITTALS

A. Submit the following according to DDC General Conditions

B. Product Data: For each type of product indicated.

C. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

D. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.4 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Smith, Jay R. Mfg. Co.

2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

C. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.5 SLEEVE-SEAL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. Advance Products & Systems, Inc.

2. CALPICO, Inc.

3. Metraflex Company (The).

4. Pipeline Seal and Insulator, Inc.

5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel or Plastic.

3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.6 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.7 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.

2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."

3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.

4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 Cast-iron wall sleeves or Galvanized-steel wall sleeves

b. Piping NPS 6 and Larger: Cast-iron wall sleeves or Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

   a. Piping Smaller than NPS 6 Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel wall sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller than NPS 6 Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller than NPS 6 Galvanized-steel pipe sleeves or PVC-pipe sleeves.

   b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.

2. Floor plates.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of escutcheons for plumbing piping work required for this Project, with a minimum of *3* years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of escutcheons for plumbing piping specified in this section, with a minimum of *3* years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to Division 1 Specification Sections.

B. Product Data: For each type of product indicated.

C. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

D. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

2.3 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with rough-brass finish.

f. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.

2. Escutcheons for Existing Piping:

a. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.

b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

c. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.

d. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.

e. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

2. Existing Piping: Split-casting, floor plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.

B. Related Sections:

1. Section 221116 "Domestic Water Piping" for water meters inside the building.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of meters and gages for plumbing piping work required for this Project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of meters and gages for plumbing piping specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to DDC General Conditions.

B. Product Data: For each type of product indicated.

C. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

D. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions procedures.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

1.8 WARRANTY

A. Comply with General Conditions.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

a. Ashcroft Inc.

b. Marsh Bellofram.

c. Miljoco Corporation.

d. Palmer Wahl Instrumentation Group.

e. REOTEMP Instrument Corporation.

f. Trerice, H. O. Co.

g. Weiss Instruments, Inc.

2. Standard: ASME B40.200.

3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.

4. Element: Bourdon tube or other type of pressure element.

5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.

6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

7. Pointer: Dark-colored metal.

8. Window: Glass or plastic.

9. Ring: Metal.

10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.

11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

B. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. AMETEK, Inc.; U.S. Gauge.

    b. Ashcroft Inc.

    c. Marsh Bellofram.

    d. Miljoco Corporation.

    e. Palmer Wahl Instrumentation Group.

    f. REOTEMP Instrument Corporation.

    g. Trerice, H. O. Co.

    h. Weiss Instruments, Inc.

    i. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.

3. Case: Sealed type, cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter with back flange and holes for panel mounting.

4. Element: Bourdon tube or other type of pressure element.

5. Movement: Mechanical, with link to pressure element and connection to pointer.

6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

7. Pointer: Dark-colored metal.

8. Window: Glass or plastic.

9. Ring: Metal.

10. Connector Type(s): Union joint, back; with ASME B1.1 screw threads.

11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

2.4 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following, or approved equal:

    a. Trerice, H. O. Co.

    b. Cole-Parmer

    c. Grainger

2. Standard: ASME B40.200.

3. Case: Cast aluminum; 6-inch (152-mm) nominal size.

4. Case Form: Back angle unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.

7. Window: Glass or plastic.

8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.

10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

    a. Flo Fab Inc.

    b. Miljoco Corporation.

    c. Tel-Tru Manufacturing Company.

d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

e. Weiss Instruments, Inc.

f. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.

3. Case: Plastic; 6-inch (152-mm) nominal size.

4. Case Form: Back angle unless otherwise indicated.

5. Tube: Glass with magnifying lens and blue or red organic liquid.

6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F (deg C).

7. Window: Glass or plastic.

8. Stem: Aluminum or brass and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch (19 mm), with ASME B1.1 screw threads.

10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.5 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.

2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.

3. Material for Use with Copper Tubing: CNR or CUNI.

4. Material for Use with Steel Piping: CRES or CSA.

5. Type: Stepped shank unless straight or tapered shank is indicated.

6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.

7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.

8. Bore: Diameter required to match thermometer bulb or stem.

9. Insertion Length: Length required to match thermometer bulb or stem.

10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.6 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AMETEK, Inc.; U.S. Gauge.

b. Palmer Wahl Instrumentation Group.

c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

d. Weiss Instruments, Inc.

e. WIKA Instrument Corporation - USA.

f. Winters Instruments - U.S.

2. Standard: ASME B40.100.

3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.

8. Pointer: Dark-colored metal.

9. Window: Glass or plastic.

10. Ring: Metal.

11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. AMETEK, Inc.; U.S. Gauge.

   b. Palmer Wahl Instrumentation Group.

   c. Weiss Instruments, Inc.

   d. WIKA Instrument Corporation - USA.

   e. Winters Instruments - U.S.

2. Standard: ASME B40.100.

3. Case: Sealed type; plastic; 4-1/2-inch (114-mm) nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.

6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.

8. Pointer: Dark-colored metal.

9. Window: Glass or plastic.

10. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.7 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.8 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flow Design, Inc.

2. National Meter, Inc.

3. Peterson Equipment Co., Inc.

4. Sisco Manufacturing Company, Inc.

5. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

6. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4 (DN 8) or NPS 1/2 (DN 15), ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.9 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Peterson Equipment Co., Inc.

2. Sisco Manufacturing Company, Inc.

3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.

4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F (minus 4 to plus 52 deg C).

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- (25- to 51-mm-) diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F (minus 18 to plus 104 deg C).

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- (51- to 76-mm-) diameter dial and probe. Dial range shall be at least 0 to 200 psig (0 to 1380 kPa).

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.10 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Archon Industries, Inc.

2. Dwyer Instruments, Inc.

3. Emerson Process Management; Brooks Instrument.

4. Ernst Co., John C., Inc.

5. Ernst Flow Industries.

6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.

7. OPW Engineered Systems; a Dover company.

8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig (860 kPa).

E. Minimum Temperature Rating: 200 deg F (93 deg C).

F. End Connections for NPS 2 (DN 50) and Smaller: Threaded.

G. End Connections for NPS 2-1/2 (DN 65) and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid one-third of pipe diameter to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

2. Inlets and outlets of each domestic water heat exchanger.

3. Inlet and outlet of each domestic hot-water storage tank.

4. Inlet and outlet of each remote domestic water chiller.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.

2. Inlet and outlet of each pressure-reducing valve.

3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.

2. Direct-mounted, metal-case, vapor-actuated type.

3. Compact-style, liquid-in-glass type.

4. Direct-mounted, light-activated type.

5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.

2. Direct-mounted, metal-case, vapor-actuated type.

3. Compact-style, liquid-in-glass type.

4. Direct-mounted, light-activated type.

5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.

2. Direct-mounted, metal-case, vapor-actuated type.

3. Compact-style, liquid-in-glass type.

4. Direct-mounted, light-activated type.

5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

B. Scale Range for Domestic Hot-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

C. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.

2. Sealed, direct-mounted, plastic case.

3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.

2. Sealed, direct-mounted, plastic case.

3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:

1. Liquid-filled, direct-mounted, metal case.

2. Sealed, direct-mounted, plastic case.

3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.

B. Scale Range for Domestic Water Piping: 0 to 300 psi and 0 to 2500 kPa.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Iron, grooved-end butterfly valves.
5. Bronze lift check valves.
6. Bronze swing check valves.
7. Bronze gate valves.
8. Iron gate valves.
9. Bronze globe valves.
10. Iron globe valves.

B. Related Sections:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
3. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
4. Section 221423 "Storm Drainage Piping Specialties" for valves applicable only to this piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
4. Wrench: For plug valves with square heads. Furnish City of New York with 1 wrench for every 5 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. NIBCO INC.
c. Kitz Corporation

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.

C. Class 150, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.
b. Kitz Corporation.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

2.3 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Kitz Corporation.

b. Nibco, INC

c. Smith Cooper

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

2.4 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Jenkins Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-67, Type I.
    b. CWP Rating: 200 psig.
    c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    e. Seat: EPDM.
    f. Stem: One- or two-piece stainless steel.
    g. Disc: Aluminum bronze.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Kennedy Valve; a division of McWane, Inc.
    b. Tyco Fire Products LP; Grinnell Mechanical Products.
    c. Victaulic Company.

2. Description:

    a. Standard: MSS SP-67, Type I.
    b. CWP Rating: 175 psig.
    c. Body Material: Coated, ductile iron.
    d. Stem: Two-piece stainless steel.
    e. Disc: Coated, ductile iron.
    f. Seal: EPDM.

2.7 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig.
    c. Body Design: Vertical flow.
    d. Body Material: ASTM B 61 or ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Milwaukee Valve Company.
    b. NIBCO INC.
    c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 200 psig.

c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: NBR, PTFE, or TFE.

2.8 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

2.9 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.10 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.11 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

2.12 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

2.13 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Nordstrom Valves, Inc.

b. Flowserve

c. Southern California Valve

2. Description:

   a. Standard: MSS SP-78, Type II.
   b. CWP Rating: 200 psig.
   c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
   d. Pattern: Regular or short.
   e. Plug: Cast iron or bronze with sealant groove.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

   1. Swing Check Valves: In horizontal position with hinge pin level.
   2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
   3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly , gate, or plug valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or angle , ball, or butterfly valves.
4. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: One piece, regular port, brass or bronze with bronze trim.
4. Bronze Swing Check Valves: Class 125, disc.
5. Bronze Gate Valves: Class 125,.
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
4. Iron, Grooved-End Butterfly Valves: 175 CWP.
5. Iron Swing Check Valves: Class 125, metal seats.
6. Iron Gate Valves: Class 125 NRS.
7. Iron Globe Valves: Class 125.

END OF SECTION 220523

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fiberglass strut systems.
5. Pipe stands.
6. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Engineering Criteria Submittal: Provide trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and engineering criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Provide supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Provide equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Provide seismic-restraint hangers and supports for piping and equipment.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Engineering Submittal: For trapeze hangers indicated to comply with performance requirements and engineering criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cooper B-Line, Inc.
   b. Flex-Strut Inc.
   c. GS Metals Corp.
   d. Unistrut Corporation; Tyco International, Ltd.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dipped galvanized.

2.4 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit.
2. Champion Fiberglass, Inc.
3. Cooper B-Line, Inc.
4. SEASAFE, INC.; a Gibraltar Industries Company.

B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass channel with inturned lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of fiberglass.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

I. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

Q. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.

c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use mechanical expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220533 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

1. Plastic insulated, series resistance.
2. Self-regulating, parallel resistance.
3. Constant wattage.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty. Refer to DDC General Conditions.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:

1. Chromalox, Inc.
2. Nelson Heat Trace.
3. Raychem; Tyco Thermal Controls.
4. Thermon Americas Inc.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, non-heating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Cable Cover: Tinned-copper braid and polyolefin outer jacket with ultraviolet inhibitor.

F. Maximum Operating Temperature (Power On): 150 deg F.

G. Maximum Exposure Temperature (Power Off): 185 deg F.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Capacities and Characteristics for pipe mounted freeze protection and snow/ice melting:

1. Maximum Heat Output: 12 W/ft..
2. Piping Diameter: 3 inch NPS.
3. Electrical Characteristics for Single-Circuit Connection:

a. Volts: 277.
b. Phase: Single.
c. Hertz: 60.

2.2 CONTROLS

A. Pipe-Mounted Thermostats for Freeze Protection:

1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

B. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:

1. Microprocessor-based control with manual on, automatic, and standby/reset switch.
2. Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:

   a. Temperature Span: 34 to 44 deg F.
   b. Adjustable Delay-Off Span: 30 to 90 minutes.
   c. Energize Cables: Following two-minute delay if ambient temperature is below set point and precipitation is detected.
   d. De-Energize Cables: On detection of a dry surface plus time delay.

3. Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.
4. Minimum 30-A contactor to energize cable or close other contactors.
5. Precipitation sensor shall be freestanding.
6. Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control-system workstation.

C. Temperature Controller for Pipe Mounted Freeze Protection:
1. Provide one temperature controller for each group of 4 to 6 heater segments. Set controller to energize the group of parallel connected heaters when the air temperature is 38 deg F or lower. The controller shall provide ground fault protection per NEC allowing the use of standard branch circuit breakers.
2. Master power panel shall be 480 volt, 3 phase, 60 Hz.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Heating cable attachment clips.

C. Branch circuit wiring from local panel board to contactor and from contactor to heating cables.

D. Control wiring between the sensors, thermostats and contactors.

E. Warning Labels: Refer to Section 220553 "Identification for Plumbing Piping and Equipment."

F. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.

2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Install the following types of electric heating cable for the applications described:

1. Snow and Ice Melting on Roofs and in Gutters and Downspouts: Self-regulating, parallel-resistance heating cable.
2. Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.

3.3 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.

C. Electric Heating-Cable Installation for Freeze Protection for Piping:

1. Install electric heating cables after piping has been tested and before insulation is installed.
2. Install electric heating cables according to IEEE 515.1.
3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

D. Electric Heating-Cable Installation for Temperature Maintenance for Domestic Hot Water:

1. Install electric heating cables after piping has been tested and before insulation is installed.

2. Install insulation over piping with electric heating cables according to Section 220719 "Plumbing Piping Insulation."
3. Install warning tape on piping insulation where piping is equipped with electric heating cables.

E. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

E. Cables will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed heating cables, including non-heating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Brass.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Pre-printed or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels , complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

   a. Background Color: Black.
   b. Letter Color: Red.

2. Sanitary Waste Piping:

   a. Background Color: Black.
   b. Letter Color: Red.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Color:

   a. Cold Water: Natural.
   b. Hot Water: Natural.

3. Letter Color:

   a. Cold Water: Black.
   b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

This Page Intentionally Left Blank

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Jacket Materials for Pipe: 12 inches long by NPS 2.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot section of NPS 2 straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
e. Four support hangers including hanger shield and insert.

f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

D. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in accordance with latest energy code, and the requirements of this section.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide the following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Johns Manville; Microlite.
    b. Manson Insulation Inc.; Alley Wrap.
    c. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Johns Manville; Micro-Lok.
    b. Manson Insulation Inc.; Alley-K.
    c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for

above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099000 – Painting and Finishing.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Commissioner. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations

of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1/2 inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:

   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thicks.

3.16 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
   1. PVC, Color-Coded by System: 20 mils thick.

D. Piping, Exposed:
   1. PVC, Color-Coded by System: 20 mils thick.

3.17 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221113

FACILITY WATER DISTRIBUTION PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.

B. Related Sections:

1. Section 312000 - Earthwork
2. Section 312319 – Dewatering
3. Section 315000 – Excavation Support and Protection

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

B. DIP: Ductile Iron Pipe

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

C. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends and flange faces.

3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify the Commissioner no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of water-distribution service without Commissioner's written permission.

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

1.11 REFERENCED DOCUMENT

A. New York City Standard Water Main Specifications, prepared by the Bureau of Water and Sewer Operations, Department of Environmental Operation, dated August 1, 2009 or its latest edition.

PART 2 PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2. Copper, Pressure-Seal Fittings:

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Viega; Plumbing & Heating Systems.

4. NPS 2"and smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

5. NPS 2-1/2" to NPS 4"Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Hard Copper Tube: ASTM B 88, Type Kwater tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2. Copper, Pressure-Seal Fittings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1). Viega; Plumbing & Heating Systems.

b. NPS 2" and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

c. NPS 2-1/2" to NPS 4": Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Gaskets: AWWA C111, rubber.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Anvil International, Inc.
2) Victaulic Company of America.

C. Flanges: ASME 16.1, Class 125, cast iron.

2.3 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.

B. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

C. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.

2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.5 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American AVK Co.; Valves & Fittings Div.

b. American Cast Iron Pipe Co.; American Flow Control Div.

c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

d. Crane Co.; Crane Valve Group; Stockham Div.

e. East Jordan Iron Works, Inc.

f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

g. McWane, Inc.; Kennedy Valve Div.

h. McWane, Inc.; M & H Valve Company Div.

i. McWane, Inc.; Tyler Pipe Div.; Utilities Div.

j. Mueller Co.; Water Products Div.

k. NIBCO INC.

l. U.S. Pipe and Foundry Company.

2. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
   1). Standard: AWWA C509.
   2). Minimum Pressure Rating: 200 psig
   3). End Connections: Mechanical joint.
   4). Interior Coating: Complying with AWWA C550.

2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

b. East Jordan Iron Works, Inc.

c. Flowserve.

d. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

e. McWane, Inc.; Kennedy Valve Div.

f. McWane, Inc.; M & H Valve Company Div.

g. Mueller Co.; Water Products Div.

h. U.S. Pipe and Foundry Company.

2. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.

b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.

c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.7 CHECK VALVES

A. AWWA Check Valves:

1. Available Manufacturers: Subject to compliance with requirements, for NPS 2" or larger, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American AVK Co.; Valves & Fittings Div.

b. American Cast Iron Pipe Co.; American Flow Control Div.

c. APCO Williamette; Valve and Primer Corporation.

d. Crane Co.; Crane Valve Group; Crane Valves.

e. Crane Co.; Crane Valve Group; Stockham Div.

f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

g. McWane, Inc.; Kennedy Valve Div.

h. McWane, Inc.; M & H Valve Company Div.

i. Mueller Co.; Water Products Div.

j. NIBCO INC.

k. Watts Water Technologies, Inc.

2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

a. Standard: AWWA C508.

b. Pressure Rating: 175 psig

2.8 DETECTOR CHECK VALVES

A. Detector Check Valves:

1. Available Manufacturers: Subject to compliance with requirements, for NPS 2-1/2" and larger, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ames Fire & Waterworks; a division of Watts Regulator Co.

b. Badger Meter, Inc.

c. FEBCO; SPX Valves & Controls.

d. Globe Fire Sprinkler Corporation.

e. McWane, Inc.; Kennedy Valve Div.

f. Mueller Co.; Hersey Meters.

g. Victaulic Company of America.

h. Viking Corporation.

i. Watts Water Technologies, Inc.

2. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

a. Standards: UL 312 and FMG approved.

b. Pressure Rating: 175 psig.

c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

B. Butterfly Valves

1. AWWA Butterfly Valves:

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1). DeZURIK/Copes-Vulcan; a unit of SPX Corporation.

2). Milliken Valve Company.

3). Mosser Valve; a division of Olson Technologies, Inc.

4). Mueller Co.; Water Products Div.

5). Pratt, Henry Company.

6). Val-Matic Valve & Manufacturing Corp.

b. Description: Rubber seated.

1). Standard: AWWA C504.

2). Body: Cast or ductile iron.

3). Body Type: Wafer

4). Pressure Rating: 150 psig

2. UL Butterfly Valves:

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1). McWane, Inc.; Kennedy Valve Div.

2). Milwaukee Valve Company.

3). Mueller Co.; Water Products Div.

4). NIBCO INC.

2.9 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American AVK Co.; Valves & Fittings Div.

b. American Cast Iron Pipe Co.; American Flow Control Div.

c. American Cast Iron Pipe Co.; Waterous Co. Subsidiary.

d. American Foundry Group, Inc.

e. East Jordan Iron Works, Inc.

f. McWane, Inc.; Clow Valve Co. Div. (Oskaloosa).

g. McWane, Inc.; Kennedy Valve Div.

h. McWane, Inc.; M & H Valve Company Div.

i. Mueller Co.; Water Products Div.

j. Troy Valve; a division of Penn-Troy Manufacturing, Inc.

k. U.S. Pipe and Foundry Company.

2. Description: Freestanding, with one NPS 4-1/2and two NPS 2-1/2outlets, 5-1/4-inchmain valve, drain valve, and NPS 6mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502. Or UL 246, FMG approved.

b. Pressure Rating: 150 psig minimum.

c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.

d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.

e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.

f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

PART 3 EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. All Underground water-and fire service piping and Underground Combined Water-Service and Fire-Service-Main Piping shall be the following:

1. Ductile-iron, push-on retrained joint pipe; joint fittings; and gasketed joint.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Retain one of first two subparagraphs below.

2. Underground Valves, NPS 3and Larger: AWWA, cast-iron, nonrising-stem resilient seated gate valves with valve box.

3. Use the following for valves in vaults and aboveground:

a. Gate Valves, NPS 2and Smaller: Bronze, nonrising stem.

b. Gate Valves, NPS 3and Larger: AWWA, cast iron, resilient seated

c. Check Valves: AWWA C508 swing type.

4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.

5. Relief Valves: Use for water-service piping in vaults and aboveground.

a. Air-Release Valves: To release accumulated air.

b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
c. Combination Air Valves: To release or admit air.

6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.

2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.

3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.

4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 2and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.

2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.

3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.

4. Install corporation valves into service-saddle assemblies.

5. Install manifold for multiple taps in water main.

6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

G. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

H. Bury piping with depth of cover over top at least 30 inches with top at least 12 inches below level of maximum frost penetration, and according to the following:

a. Under Driveways: With at least 36 inches cover over top.

b. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

I. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

J. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

K. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

L. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

N. See Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for fire-suppression-water piping inside the building.

O. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.

2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.

3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.

5. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.8 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.9 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.10 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

E. Comply with New York City Standard Water Main Specification for fire hydrants.

3.11 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

3.12 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground detectable trace wire during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground trace wires are specified in Section 334100 – Storm Drainage System."

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

    b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

    c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Products Corporation.
   b. NIBCO Inc.
   c. Viega.

2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Appurtenances for Grooved-End Copper Tubing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International.
    b. Shurjoint Piping Products.
    c. Victaulic Company.

2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
3. Mechanical Couplings for Grooved-End Copper Tubing:

    a. Copper-tube dimensions and design similar to AWWA C606.
    b. Ferrous housing sections.
    c. EPDM-rubber gaskets suitable for hot and cold water.
    d. Bolts and nuts.
    e. Minimum Pressure Rating: 300 psig.

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black or natural.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Manufacturing.
    b. Dresser, Inc.; Piping Specialties Products.
    c. Ford Meter Box Company, Inc. (The).
    d. JCM Industries.
    e. Romac Industries, Inc.
    f. Smith-Blair, Inc.; a Sensus company.
    g. Viking Johnson.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Colonial Engineering, Inc.
   b. NIBCO Inc.
   c. Spears Manufacturing Company.

2. Description:

   a. CPVC or PVC four-part union.
   b. Brass threaded end.
   c. Solvent-cement-joint or threaded plastic end.
   d. Rubber O-ring.
   e. Union nut.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

H. Install domestic water piping level without pitch and plumb.

I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

J. Install seismic restraints on piping.

K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install PEX piping with loop at each change of direction of more than 90 degrees.

S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

T. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

U. Install thermostats in hot-water circulation piping.

V. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and

fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Piping: Join according to ASTM D 2855.

N. Joints for PEX Piping: Join according to ASTM F 1807.

O. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

G. Install supports for vertical steel piping every 15 feet.

H. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6: 12 feet with 3/4-inch rod.
8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

I. Install supports for vertical stainless-steel piping every 15 feet.

J. Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.

3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

K. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

L. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.

M. Install hangers for vertical PEX piping every 48 inches.

N. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

O. Install supports for vertical PVC piping every 48 inches.

P. Install vinyl-coated hangers for PP piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
3. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
4. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
5. NPS 6: 48 inches with 3/4-inch rod.
6. NPS 8: 48 inches with 7/8-inch rod.

Q. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

R. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:

      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Repeat procedures if biological examination shows contamination.
   e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type L;copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.

E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L;copper, solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; grooved-joint, copper-tube appurtenances; and grooved joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water-hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.
18. Specialty valves.
19. Flexible connectors.
20. Water meters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
4. Section 224713 "Drinking Fountains" for water filters for water coolers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, and approved by NYC DEP:

   a. Conbraco Industries, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/2.
5. Body: Bronze.
6. End Connections: Union, solder joint.
7. Finish: Chrome plated.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. FEBCO; a division of Watts Water Technologies, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Size: see drawings.
6. Design Flow Rate: see drawings.
7. Selected Unit Flow Range Limits: see drawings.
8. Pressure Loss at Design Flow Rate: for sizes NPS 2 and smaller; see drawings for NPS 2-1/2 and larger.

9. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Configuration: Designed for vertical-inlet, horizontal-center-section, and vertical-outlet flow.
12. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. FEBCO; a division of Watts Water Technologies, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Size: see drawings.
6. Design Flow Rate: see drawings.
7. Selected Unit Flow Range Limits: see drawings.
8. Pressure Loss at Design Flow Rate: see drawings for sizes NPS 2 and smaller;see drawings for NPS 2-1/2 and larger.
9. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Configuration: Designed for horizontal, straight-through flow.
12. Accessories:

    a. ValvesNPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. ValvesNPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

D. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.

4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

E. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Conbraco Industries, Inc.
   b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
   c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CLA-VAL.
   b. Watts; a division of Watts Water Technologies, Inc.; Control Valves (Watts ACV).
   c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.

   a. Size: see drawings.
   b. Pattern: Angle-valve design.
   c. Trim: Stainless steel.

5. Design Flow: see drawings.
6. Design Inlet Pressure: see drawings.
7. Design Outlet Pressure Setting: see drawings.
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. ITT Corporation; Bell & Gossett Div.
    c. NIBCO Inc.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psigminimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: see drawings.
9. Tempered-Water Design Flow Rate: see drawings.
10. Selected Valve Flow Rate at 45-psig Pressure Drop: see drawings.
11. Pressure Drop at Design Flow Rate: see drawings.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.

5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.020 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
   c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Pipe plug.

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products.
   d. Woodford Manufacturing Company; a division of WCM Industries, Inc.
   e. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.

7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

2.11 GROUND HYDRANTS

A. Nonfreeze Ground Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. MIFAB, Inc.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products.
    d. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, concealed-outlet ground hydrant with box.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Inlet: NPS 3/4.
7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Box: Standard pattern with cover.
10. Box and Cover Finish: Polished nickel bronze.
11. Operating Key(s): One with each ground hydrant.
12. Vacuum Breaker: ASSE 1011.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. MIFAB, Inc.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Watts Drainage Products.
    d. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.15 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. MIFAB, Inc.
    b. Precision Plumbing Products, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

    b. Mifab

    c. Sureseal, Division of Rectorseal

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

2.16 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

    a. Precision Plumbing Products, Inc.

    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

    c. Mifab

2. Standard: ASSE 1044.
3. Piping: NPS 3/4, ASTM B 88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless-steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.

    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: see drawings.
8. Size Outlets: NPS 1/2.

2.17 WATER METERS

A. Compound-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

    a. ABB.
    b. Badger Meter, Inc.
    c. Master Meter, Inc.

d. Mueller Co. Ltd.; a subsidiary of Mueller Water Products Inc.
e. Schlumberger Limited; Water Services.

2. Description:

a. Standard: AWWA C702.
b. Pressure Rating: 150-psig working pressure.
c. Body Design: With integral mainline and bypass meters; totalization meter.
d. Registration: In gallons or cubic feet as required by utility company.
e. Case: Bronze.
f. Pipe Connections: Flanged.

B. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves.

C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve solenoid valve and pump.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

H. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

I. Set nonfreeze, nondraining-type post hydrants in concrete or pavement.

J. Set freeze-resistant yard hydrants with riser pipe in concrete or pavement. Do not encase canister in concrete.

K. Install water-hammer arresters in water piping according to PDI-WH 201.

L. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

M. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

N. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

O. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check, backflow-prevention assemblies.
5. Carbonated-beverage-machine backflow preventers.
6. Dual-check-valve backflow preventers.
7. Reduced-pressure-detector, fire-protection, backflow-preventer assemblies.
8. Double-check, detector-assembly backflow preventers.

9. Water pressure-reducing valves.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water mixing-valve assemblies.
13. Photographic-process, thermostatic, water mixing-valve assemblies.
14. Primary water tempering valves.
15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each reduced-pressure-principle backflow preventer and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

This Page Intentionally Left Blank

SECTION 221123.13 - DOMESTIC-WATER PACKAGED BOOSTER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Multiplex, variable-speed booster pumps.

1.3 DEFINITIONS

A. VFC: Variable-frequency controller(s).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For booster pumps. Include plans, elevations, sections, details, and attachments to other work.

   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For booster pumps, accessories, and components, from manufacturer.

   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Comply with ASME B31.9 for piping.

C. UL Compliance for Packaged Pumping Systems under Category QCZJ:

1. UL 508, "Industrial Control Equipment."
2. UL 508A, "Industrial Control Panels."
3. UL 778, "Motor-Operated Water Pumps."
4. UL 1995, "Heating and Cooling Equipment."

D. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Retain protective coatings and flange's protective covers during storage.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 MULTIPLEX, VARIABLE-SPEED BOOSTER PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Canariis Corporation.
2. Delta P Carver.
3. SyncroFlo, Inc.

B. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.

C. Pumps:

1. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, frame-mounted, separately coupled, single-stage, overhung-impeller, centrifugal pump. Include back-pullout design.
2. Casing: Radially split; cast iron.
3. Impeller: Closed, ASTM B 584 cast bronze; statically and dynamically balanced and keyed to shaft.
4. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
5. Seal: Mechanical.
6. Bearing: Grease-lubricated or pre-greased, permanently shielded ball type.
7. Motor shall be close coupled type with a JM shaft.

D. Piping: Schedule 10, 300 series stainless-steel pipe and fittings.

E. Valves:
1. Shutoff Valves NPS 2-1/2 and Larger: full port lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers.
2. Check Valves NPS 2-1/2 and Larger: Wafer style, silent type, non-slam with cast iron body, sized at a maximum loss of 3 PSIG at total design flow, in each pump's discharge piping.
3. Thermal Purge Valve: Temperature-and-pressure relief type on the discharge of each pump.

F. Pressure Sensor/Transmitter:
1. The pressure sensor/transmitter shall provide a 4 to 20 mA DC output, compatible with the system controls, temperature and pressure requirements. The pressure sensor/transmitter shall have zero span and damping devices The transmitter shall be installed on the system discharge pipe header and factory wired to the control panel.

G. Variable Frequency Drives
1. Two variable frequency drives shall be factory mounted on the pump skid. The frequency drives shall be of the PWM type and suitable for variable torque applications using standard NEMA Design B squirrel cage induction motors. Variable frequency drives shall be sized for the maximum possible amp draw throughout the programmed sequence of pump operation.
2. Efficiency at full load and full speed shall be 97% with a fundamental power factor of 0.98.
3. Standard features shall include, but not be limited, to the following":
   a. Pulse width modulated.
   b. Starts into a rotating load.
   c. Keypad operator device with the following:
      1) 2 line backlit LCD display.
      2) Power on and alarm/fault displays.
      3) In "Auto" the drive follows the signal from the logic section of the control panel.
      4) Hand/Off/Auto switch and manual speed adjustment.
      5) Auto drive shutdown for electrical fault.
      6) Automatic restart after power failure shutdown.
      7) Operational data displays include:
         a) Drive speed (Hz).
         b) Motor power.
         c) Energy (kWh).

d) Current.
e) Elapsed time.
f) RPM.
g) Motor voltage.

8) Complete service diagnostics with service log.

H. Dielectric Fittings: With insulating material isolating joined dissimilar metals.

I. Control Panel: UL listed factory installed, and connected as an integral part of booster pump; automatic for multiple-pump, variable-speed operation, with load control and protection functions.

1. The programmable logic controller shall be factory mounted and wired on the pump skid in an enclosure to interface the signal from the pressure sensor to the VFD's and to provide a stable response to either speed up or slow down the pump or to add the lag pump to meet the system's demand requirements.
2. The controller shall provide setpoint adjustment, timer adjustment, PID functions as well as both system and controller self-diagnostics via a 2 line 20 character display with keypad. All user interface set points shall be accessible via the password protected display screen. Normal operation shall be tuned to eliminate to avoid hunting.
3. The controller shall have one RS 485 Communication port, real time calendar/clock and EEPROM master transfer cartridge.
4. Control Logic: Solid-state system with transducers, programmable microprocessor, VFC, and other devices in controller.
5. Motor Controller: NEMA ICS 2, variable-frequency, solid-state type.
   a. Control Voltage: 120-V ac, with integral control-power transformer.
6. Enclosure: NEMA 250, Type 1.
7. Motor Overload Protection: Overload relay in each phase.
8. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.

   a. Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.

9. Pump Operation and Sequencing: Pressure-sensing method.

   a. Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.

10. VFC: Voltage-source, pulse-width, modulating-frequency converter for each pump.
11. Manual Bypass: Magnetic contactor arranged to transfer to constant-speed operation upon VFC failure.
12. Instrumentation: Suction and discharge pressure gages.
13. Lights: Running light for each pump.
14. Alarm Signal Device: Sounds alarm when backup pumps are operating.

    a. Time Delay: Controls alarm operation; adjustable from 1 to 300 seconds, with manual reset.

15. Thermal-bleed cutoff.
16. High-suction-pressure cutout.
17. Low-discharge-pressure cutout.
18. High-discharge-pressure cutout.

19. Direct Digital Control (DDC) System for HVAC: Provide auxiliary contacts for interface to DDC system. DDC systems are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC." Include the following:

    a. On-off status of each pump.
    b. Alarm status.

J. Base: The booster system shall be assembled on a steel skid including pumps, motors, valves, manifolds, all interconnecting piping, wiring and controls.

K. Capacities and Characteristics:

1. Refer to schedule on drawings.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

B. Motors: Single speed, open drip proof manufactured in accordance with NEMA standards. Select motors that will not overload through full range of pump performance curve.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

2.3 HYDRO-PNEUMATIC TANK

A. Provide a hydro-pneumatic tank with a carbon steel shell and a replaceable F.D.A. approved heavy duty bladder to separate the air and water. No water shall come in contact with the metal walls of the tank. Features shall include an air fill valve and a bottom connection suitable for 100% drawdown.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.

3.2 INSTALLATION

A. Equipment Mounting:

1. Install booster pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

B. Support connected domestic-water piping so weight of piping is not supported by booster pumps.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic-water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge headers.

1. Install shutoff valves on piping connections to booster-pump suction and discharge headers. Install ball, butterfly, or gate valves same size as suction and discharge headers. Comply with requirements for general-duty valves specified in Section 220523.
2. Install union, flanged, or grooved-joint connections on suction and discharge headers at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Section 221116 "Domestic Water Piping."
3. for flexible connectors specified in Section 221116 "Domestic Water Piping."
4. Install piping adjacent to booster pumps to allow service and maintenance.

3.4 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 SEQUENCE OF OPERATION

A. The lead pump shall run only as necessary to maintain system pressure and will be controlled automatically by means of a pressure sensor/transmitter and programmable logic controller (PLC) programmed to prevent short cycling. If the lead pump is unable to maintain system pressure the lag pump will be called on after a time delay and will operate in parallel with the lead pump in accordance with the PLC program. When one pump can handle the system demand the controls will shut down the lag pump. When a low or no flow condition is reached, the controls will accelerate the lead pump to charge the system and the hydro-pneumatic tank then shut down. The pumps will alternate between lead and lag designations.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform visual and mechanical inspection.
2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Adjust booster pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust pressure set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct Owner's maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION 221123.13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:
1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 50 psig.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

C. LEED Submittals Requirements

1. For all installed products and materials of this Section which are within the LEED boundary, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information for this Form shall include:

a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy class(es).

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky.
   b. MIFAB, Inc.
   c. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Dallas Specialty & Mfg. Co.
      2) Fernco Inc.
      3) Mission Rubber Company; a division of MCP Industries, Inc.
      4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

   b. Standard: ASTM C 1173.
   c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. Sleeve Materials:

      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Cascade Waterworks Mfg. Co.
      2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground PVC piping according to ASTM D 2321.

T. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

U. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

W. Install force mains at elevations indicated.

X. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Z. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

AA. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

BB. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

   a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
   b. NPS 2 and Larger: Pressure transition couplings.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install fiberglass pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.

5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

J. Install supports for vertical PVC piping every 48 inches.

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI hubless-piping couplings; and coupled joints.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and sovent stack fittings; CISPI hubless-piping couplings; and coupled joints.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; coupled joints.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

END OF SECTION 221316

This Page Intentionally Left Blank

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Roof flashing assemblies.
6. Through-penetration firestop assemblies.
7. Miscellaneous sanitary drainage piping specialties.
8. Flashing materials.
9. Solids interceptors.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for storm drainage piping inside the building, drainage piping specialties, and drains.
2. Section 334100 "Storm Drainage System" for storm draining piping and piping specialties outside the building.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. FOG disposal systems.
2. Grease interceptors.
3. Grease removal devices.
4. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. MIFAB, Inc.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) MIFAB, Inc.
      2) Smith, Jay R. Mfg. Co.
      3) Watts Drainage Products.
      4) Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Stainless-steel tee with side cleanout as required to match connected piping.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Closure: Stainless-steel plug with seal.

B. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.
   c. Watts Drainage Products.
   d. Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.
   c. Watts Drainage Products.
   d. Zurn Plumbing Products Group;.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not required.
6. Anchor Flange: required.
7. Clamping Device: Required.
8. Outlet: Bottom.

2.4 TRENCH DRAINS

A. Trench Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 for trench drains.
3. Material: Ductile or gray iron.
4. Flange: Anchor.
5. Clamping Device: Required.
6. Outlet: Bottom.

7. Grate Material: Ductile iron or gray iron.
8. Grate Finish: Painted.
9. Top Loading Classification: Medium Duty.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

2.5 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ayrlett, LLC.
    b. Durgo, Inc.
    c. Oatey.
    d. ProSet Systems Inc.
    e. RectorSeal.
    f. Studor, Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

B. Stack Air-Admittance Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Durgo, Inc.
    b. Oatey.
    c. Studor, Inc.

2. Standard: ASSE 1050 for vent stacks.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected stack vent or vent stack.

2.6 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company; Elmdor/Stoneman Div.

b. Thaler Metal Industries Ltd.

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.
b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. ProSet Systems Inc.

b. Hilti

c. 3M

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

I. Expansion Joints:

1. Standard: ASME A112.21.2M.

2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.9 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.10 GREASE INTERCEPTORS

A. Flush with floor Grease Recovery Unit.

1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
2. Structural Design Loads:
   a. Walkway Load: Comply with ASTM C 890, A-03.
3. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
4. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
c. Include indented top design with lettering cast into cover, using wording equivalent to " GREASE INTERCEPTOR."

B. Capacities and Characteristics: see drawings

2.11 SOLIDS INTERCEPTORS

A. Solids Interceptors:

1. Cast-Iron or Steel Solids Interceptors:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) MIFAB, Inc.
2) Smith, Jay R. Mfg. Co.
3) Watts Drainage Products.
4) Zurn Plumbing Products Group.

2. Type: Factory-fabricated interceptor made for removing and retaining sediment from wastewater.
3. Body Material: Cast iron or steel.
4. Interior Separation Device: Baffles.
5. Interior Lining: Corrosion-resistant enamel.
6. Exterior Coating: Corrosion-resistant enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:
1. Comply with requirements for vibration isolation devices as per all manufacturer's recommendations.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface, unless otherwise indicated.

H. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to ASME A112.3.1. Install on support devices so that top will be flush with surface.

I. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

J. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

L. Install fixture air-admittance valves on fixture drain piping.

M. Install stack air-admittance valves at top of stack vent and vent stack piping.

N. Install air-admittance-valve wall boxes recessed in wall.

O. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

P. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

Q. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

R. Assemble open drain fittings and install with top of hub 2 inches above floor.

S. Install deep-seal traps on floor drains and other waste outlets, if indicated.

T. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

U. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

V. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

W. Install vent caps on each vent pipe passing through roof.

X. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

Y. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Z. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

AA. Assemble components of FOG disposal systems and install on floor. Install trap, vent, fresh-air inlet, and flow-control fitting according to authorities having jurisdiction. Install shelf fastened to reinforcement in wall construction and adjacent to unit, unless otherwise indicated. Install culture bottle, culture metering pump, timer, and control on shelf. Install tubing between culture bottle, metering pump, and chamber.

BB. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.

4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

CC. Install grease removal devices on floor. Install trap, vent, and flow-control fitting according to authorities having jurisdiction. Install control panel adjacent to unit, unless otherwise indicated.

DD. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and are connected to sanitary drainage and vent systems.

EE. Install wood-blocking reinforcement for wall-mounting-type specialties.

FF. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. FOG Disposal Systems: Connect inlet and outlet to unit, connect flow-control fitting and fresh-air inlet piping to unit inlet piping, and connect vent piping between trap and media chamber. Connect electrical power.

D. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

E. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.

F. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. FOG disposal systems.
2. Grease interceptors.
3. Grease removal devices.
4. Oil interceptors.
5. Solids interceptors.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221329

SANITARY SEWERAGE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Submersible sewage pumps.
   2. Sewage-pump, pits.
   3. Packaged, submersible sewage-pump units.

B. Related Sections include the following:
   1. Section 221429 "Sump Pumps" for applications in storm-drainage systems.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of sanitary sewerage pumps work required for this Project, with a minimum of *3* years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.
   1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of sanitary sewerage pumps specified in this section, with a minimum of *3* years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility and warranty.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

E. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to the DDC General Conditions.

B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Wiring Diagrams: For power, signal, and control wiring.

D. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

E. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and

processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions procedures.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

B. Retain shipping flange protective covers and protective coatings during storage.

C. Protect bearings and couplings against damage.

D. Comply with pump manufacturer's written rigging instructions for handling.

1.7 WARRANTY

A. Comply with General Conditions.

B. In addition to the requirements of 1.4 Quality Assurance, the pump manufacturer shall warrant the pumps being supplied for a period of five (5) years from date of shipment under normal operation and service. The warranty shall include parts and labor. The pump manufacturer shall warrant the motors for twenty (20) years from date of shipment.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 PRODUCT

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 SUBMERSIBLE SEWAGE PUMPS

A. Submersible, Quick-Disconnect Sewage Pumps: Factory-assembled and -tested, duplex, single-stage, centrifugal, end-suction, submersible, direct-connected sewage pumps complying with UL 778 and with HI 1.1-1.2 and HI 1.3 for submersible sewage pumps and with SWPA's "Submersible Sewage Pumping Systems (SWPA) Handbook" for guide-rail supports. Pumps shall have the ability to run dry and shall be designed to pump air and liquid in combination without becoming airbound. Pumps, motors, controls and basins shall be suitable for high temperature when indicated on the Schedule. Pumps shall be furnished as a SubRig preassembled package.

1. Manufacturer Basis of Design or approved equal:
   a. Flygt; ITT Corp - GAF Series (basis of design)
   b. Xylem
   c. Grainger
   d. Or approved equal

2. Casing: ASTM A 48, Class 30B or higher gray iron construction, all external bolts and nuts shall be stainless steel. Casing shall be designed to seat the entire weight of the pump on the fixed discharge connection such that the pump inlet is elevated above the pit floor to permit free flow into the impeller.
3. Impellers: Shall be dynamically balanced, corrosion and wear resistant, fiberglass reinforced, Polyamide.
4. Mechanical seals: Shall consist of two (2) totally independent seal assemblies operating in a lubricant chamber. The tandem seals shall have two separate tungsten-carbide lapped face rings, no common parts shall be shared between the seals. The lower compression spring shall be protected against exposure to the pumped liquid. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The mechanical seals and pump shall be designed and produced by the same manufacturer.
5. The motor shall have a dry air filled shell with Class F insulation, designed for 155 oC maximum and voltage tolerance shall be +10% and -14%. The motor shall be capable of 15 equal starts per hour and shall be non-overloading of the complete pump curve. Pump and motor shall be capable of running continuously in a totally dry condition. Provide a junction chamber with terminal board having a watertight sealing gland between chamber and motor housing. The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the housing. Motors shall have, protective thermal sensors imbedded in the windings and wired to the control panel. The motor cable shall be non-wicking with strain relief at the junction chamber, strain relief and water sealing shall function separately.
6. Guide-Rail Supports: Include the following for each sewage pump:
    a. Guide Rails: Vertical pipes made of stainless steel, attached to baseplate and cover.
    b. Baseplate: Stainless steel baseplate, attached to basin floor, supporting guide rails and stationary elbow.
    c. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges.
    d. Stationary Elbow: Fixed discharge-elbow fitting with flange for metal to metal seal with the pump flange (no gaskets) and support attached to baseplate.
    e. Lifting Chain: Galvanized steel; attached to pump and cover.
7. Pump Discharge Piping: Preassembled package, SubRig prefabricated submersible pump assembly package to facilitate installation. The SubRig shall consist of cast iron discharge elbows; Flygt HDL, full port self cleaning ball check valves; full port fused Teflon ball isolation valves; color coded, grooved, interconnecting seamless galvanized steel discharge pipe and fittings terminating in a true Y connection. The SubRig shall also contain all necessary installation hardware including: 304 stainless steel pump base, anchor bolts and pump guide rails; cast iron sliding brackets; and galvanized lifting chain. The SubRig shall be designed such that permanent fastening of the assembly is the last step of the installation assuring that the pumps will be correctly aligned with the cover.
8. Furnish and install a Flygt or approved equal (from list of manufacturers above in (1)) Mix-Flush valve to be mounted on pump liquid end. The valve shall be non-electric, adjustable, ball type rated for Class I, Division I, Groups C and D. The Mix-Flush valve shall eliminate sludge and grease cake build up, sedimentation and settling in the pit.

B. Pit Cover: Polished aluminum diamond plate, FPS odor tight, gasketed with aluminum frame and cover suitable for pedestrian loading. Frame and cover shall be two piece removable construction to facilitate installation and future replacement. The cover shall have a hinged access hatch for pump removal. The hatch shall have a removable T handle, stainless gas springs for easy opening

and adjustable slam latch for a tight seal. Cover shall be flush with the finished floor including the latch release and hinges. Piping penetrations shall be by means of factory installed, heavy rubber, environ seals. Cover appurtenances: guide rail brackets, lifting chain, level sensor cable and pump cable holders shall be factory installed. Cover hinges and all fasteners shall be aluminum or stainless steel. Contractor shall construct the perimeter edges of the pit with (3-1/2" deep x 3-1/2" wide step (standard 4x4 lumber) to insure flush installation of the cover.

C. Controller: NEMA-250, Type 4, watertight / dust-tight gasketed enclosure with drip shield, for 3 phase, 60 HZ, 3 wire power supply, including:

1. Circuit Breaker disconnect switches interlocked with compartment door
2. Three pole across-the-line motor starters with three phase thermal overload protection and external reset buttons
3. 115 volt and 24 volt control power circuit transformers fused on both the primary and secondary sides with individual power available lights and auxiliary alarm contacts.
4. Logic control module and HMI color touch screen.
5. H-O-A selector switches with "H-O-A Off" auxiliary alarm contact.
6. Motor insulation fault monitor.
7. Flush-Cleanse Circuit.
8. Audible alarm, silencing push-button and remote trouble alarm contacts.
9. Set of necessary control relays and other accessory devices required to permit the system to operate in conformance with the specifications.
10. All components shall be mounted on back panels.
11. All power supplies shall have loss of power alarm contacts.
12. All internal wiring shall be numbered corresponding to the wiring diagrams.
13. All connections to auxiliary contacts and control components, whether remote or panel mounted, shall be made to terminal strips.
14. The control panel shall bear the UL508 label of Underwriters Laboratories signifying that all work performed by the manufacturer is in compliance with the requirements of the Underwriters Laboratories. Approval of just the enclosure or electrical devices is unacceptable.
15. The controller shall be configured to accept both power feed arrangements: one main power feed, or individual power feeds to each pump, to be determined in the field at the time of installation. The transformer shall have a, flip-flop, automatic transfer circuit on the primary side to insure continuous power under either arrangement.
16. The controller shall include auxiliary contacts (Form "C" (1-NO, 1-NC)) and analog output signal for interface with building automation system, for the following:
    a. Control power available.
    b. On-off status of each pump.
    c. Common system trouble alarm status.
    d. Wet well level indication, 4-20 mA output signal.
17. Control panels which rely upon a programmable logic controller ("PLC") or employ electronic level sensors shall have redundant electromechanical devices which function to maintain automatic pump operation and alarm activation in the event of control failure.

D. Logic Control Module: Shall be a SCADA ready, intelligent, modular unit, capable of data acquisition, processing, logging, alarm management and communication. The interactive HMI color touch screen shall have a bright high resolution 7" display not less than 800 x 480 pixels. The device shall have multiple screens and multiple operator security password levels. The primary screen shall provide for a minimum of twenty-six (26) visual and touch status points.
1. It shall graphically represent the real time status and provide set point adjustments of the following system components:

a. wet well water level
b. pump activation levels
c. pump run
d. pump run elapsed time log
e. wet well water temperature
f. wet well quench system
g. Flush-cleanse system
h. high water level alarm
i. low water level alarm
j. high water temperature alarm
k. back-up float
l. time & date

2. The logic control module shall be designed for serviceability.
   a. Should the touch screen become damaged, the level control system shall continue to operate normally until the touch screen is replaced.

E. Sequence of operation shall be as follows: Upon increasing liquid level the lead pump sensor shall activate, lead pump shall start and pump down to the pump off level set point. If the level continues to rise to the lag pump level set point, lag pump shall start and pump together with the lead pump down to the pump off level set point.
   1. The high water level alarm set point shall activate the alarm system should the level continue to rise.
   2. In the event of any failure of the primary level control system, a redundant level system shall operate the pumps automatically and activate the alarm indicating light and auxiliary alarm contact (no audible). The redundant system shall also provide for automatic system operation in the event that the logic controller is removed for service.
   3. In the event of a control power failure, an auxiliary alarm contact shall be activated.
   4. Pumps shall be automatically alternated via "PAL" predictable alternation logic. "PAL" shall enable the operator to input a percentage of total run time for any pump, thereby assuring either equal or un-equal run time, if so desired, for staggered pump maintenance.
   5. The controller shall monitor the integrity of motor insulation prior to every start and alarm if problem exists.
   6. The control panel shall include a Flush-Cleanse Controller to purge the pit of sediment, floating solids and grease. Twice per day the controller shall energize the Flush system and lower the liquid level of the pit below the pump stop float to a pump snore condition. The interval between Flush-Cleanse cycles and the duration of the cycle may be operator selected. During the cycle, the low water level alarm system shall be deactivated.

F. Level sensor: Submersible level transducer, suspended type, 316 stainless steel construction, reverse polarity, and surge protected, vented to atmosphere, having a 4-20 mA output. The transducer shall monitor wet well level and temperature. It shall be installed and held in position by means of a guide pipe retrieval mounting fixture. One differential level sensor shall be installed as a redundant level control device.

G. Junction Box: FPS-DJB, NEMA 4, double junction box, environmentally sealed to prevent the intrusion of corrosive sewer gases and humidity to the electrical connections and the pump control panel while facilitating installation and the removal of pumps for inspection & service. Each box shall be a minimum of 10" x 12" x 5" deep. The lower box shall have two (2) 2" conduit bottom connections for ease of pulling the pump and level control cables from the wet well. The upper and lower boxes shall be rigidly assembled with multiple individual, sealed, strain relief gland seals for pump power and level control cables; the quantity of these connections shall be suited for the equipment provided on this project. Electrical connections from the wet well and controller shall be made at the terminal strip in the upper box. Cable gland

seal plugs, permanently attached in the upper box, shall maintain the integrity of the environmental seal when cables are removed for pump inspection or service.

H. The Pump Manufacturer's Representative shall have single source responsibility for the pumps and complete control system.

I. Capacity and Characteristics: (See Schedule.)

2.4 ELEVATOR PIT SUMP PUMPS

A. Provide, as shown on the plans, a simplex "Oil Minder" elevator pit sump pump system as manufactured by Stancor and represented by G. A. Fleet Associates of Harrison, NY, or approved equal from manufacturers listed in 2.3A1. The installed pump and control system shall be a permanent installation in accordance with ASME Elevator Code A17.1. It shall be capable of automatically pumping water from the pit while preventing the discharge of oil. The control unit, pump, floats and sensor probe shall be factory assembled as a complete, ready to use system and shall be tested and approved by a nationally recognized testing laboratory such as ENTELA.
   1. Elevator sump pump systems that do not automatically prevent the discharge of oil or that alarm only in the event of a high liquid condition will not be considered for substitution. Only a complete pump and control system that has been tested and certified, by a nationally recognized testing laboratory, to perform in accordance with the specified operation shall be accepted.

B. The pump shall be a Stancor (or approved equal from manufacturers listed in 2.3A1) Oil Minder, heavy duty submersible effluent type capable of passing a minimum 3/4" solid, approved to UL 778 standards. Construction features shall include cast iron casing and impeller, mechanical seals housed in a separate oil-filled compartment and 304 stainless steel motor housing.

C. The control system shall provide for fully automatic pump operation and alarm activation in the event of:
   1. Oil present in the sump pit
   2. High liquid level
   3. High motor amps or a locked rotor

D. The control system shall include: pump control panel; self-cleaning stainless steel oil sensing probe; and dual floats for automatic pump operation and level alarm. The controls shall be factory assembled as a complete, ready to use system and shall be tested and approved to UL 508 standards.

E. The pump control panel shall be a NEMA 4X, watertight, dust tight, corrosion resistant, gasketed enclosure. The control panel shall include dual "Oil-Minder Relays" with variable sensitivity settings, magnetic contactor with separate over-current relay, Audio-visual alarm station with light, horn, alarm silencing switch, auxiliary contact for common trouble alarm and clearly marked terminal board. Manufacturer shall be from manufacturers listed in 2.3A1 or approved equal

F. Pump and float cables, 16' each, shall be provided by the manufacturer.
   1. Alternative longer cable lengths shall be provided as required, Contractor to coordinate.

G. Provide a steel frame and cover suitable for a concrete pit as shown on the drawings. The cover shall have all required openings for the pump discharge lines, float switches and pump removal.

H. Capacities, Characteristics & Quantity: (See Schedule.)

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

3.3 INSTALLATION

A. Pump Installation Standards:
   1. Comply with HI 1.4 for installation of centrifugal pumps.
   2. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.

B. Equipment Mounting: Install progressing-cavity sewage pumps on concrete base using elastomeric mounts. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
   1. Minimum Deflection: 1/4 inch.
   2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Mounting: Install progressing-cavity sewage pumps on vibration isolation equipment base.

D. Wiring Method: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Instruct City of New York's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221329

SECTION 22 14 13

FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 221429 "Sump Pumps" for storm drainage pumps.
2. Section 334100 "Storm Utility Drainage Piping" for storm drainage piping outside the building.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of facility storm drainage piping work required for this Project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of facility storm drainage piping specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable

1.4 ACTION SUBMITTALS

A. Submit the following according to DDC General Conditions.

B. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

C. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using format in DDC General Conditions.

1.5 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

2. Storm Drainage, Force-Main Piping: 100 psig.

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and as required by the New York City Plumbing Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm-Drainage Service: Do not interrupt service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager and City of New York no fewer than two days in advance of proposed interruption of storm-drainage service.

2. Do not proceed with interruption of storm-drainage service without Construction Manager's and City of New York's written permission.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.4 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.5 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.

b. MIFAB, Inc.

c. Stant.

d. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.

3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.

b. MIFAB, Inc.

c. Stant.

d. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.

3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. MG Piping Products Company.

   b. Charlotte Pipe

   c. Tyler Pipe

2. Standard: ASTM C 1277.

3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.6 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: High-density, crosslaminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1 percent to 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent to 2 percent downward in direction of flow for piping NPS 4 and larger. As required by the New York City Plumbing Code

2. Horizontal Storm-Drainage Piping: 1 percent to 2 percent downward in direction of flow. As required by the New York City Plumbing Code

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

N. Install steel piping according to applicable plumbing code.

O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

P. Install underground ABS and PVC piping according to ASTM D 2321.

Q. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.

R. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

S. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105.

T. Install force mains at elevations coordinated with field condition.

U. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

F. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.

2. In Drainage Piping: Unshielded, nonpressure transition couplings.

3. In Aboveground Force-Main Piping: Fitting-type transition couplings.

4. In Underground Force-Main Piping:

a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.

b. NPS 2 and Larger: Pressure transition couplings.

3.5 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.

2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves.

2. Install backwater valves in accessible locations.

3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.

2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.

3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.

4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.

5. Vertical Piping: MSS Type 8 or Type 42, clamps.

6. Individual, Straight, Horizontal Piping Runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.

5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.

6. Spacing for 10-foot pipe lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

2. Install horizontal backwater valves with cleanout cover flush with floor.

3. Comply with requirements for backwater valves cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Connect force-main piping to the following:

1. Storm Sewer: To exterior force main.

2. Sump Pumps: To sump pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Test Procedure: Test storm drainage piping as required by the New York City Plumbing Code on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

4. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.

3. Galvanized-steel pipe, drainage fittings, and threaded joints.

4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, storm drainage piping NPS 8 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.

3. Galvanized-steel pipe, drainage fittings, and threaded joints.

4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:

1. Extra Heavy or Service class, cast-iron soil pipe and fittings; calking materials; and calked joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, storm drainage piping NPS 8 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil pipe and fittings; gaskets; and gasketed or calking materials; and calked joints.

2. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.

3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, copper pressure fittings, and soldered joints.

2. Galvanized-steel pipe, pressure fittings, and threaded joints.

G. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, copper pressure fittings, and soldered joints.

2. Galvanized-steel pipe, pressure fittings, and threaded joints.

3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

4. Fitting-type transition couplings if dissimilar pipe materials.

H. Underground storm drainage force mains NPS 4 and smaller shall be any of the following:

1. Ductile-iron, mechanical-joint piping and mechanical joints.

2. Ductile-iron, grooved-joint piping and grooved joints.

3. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

I. Underground storm drainage force mains NPS 5 and larger shall be any of the following:

1. Ductile-iron, mechanical-joint piping and mechanical joints.

2. Ductile-iron, grooved-joint piping and grooved joints.

END OF SECTION

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Backwater valves.
5. Trench drains.
6. Channel drainage systems.
7. Through-penetration firestop assemblies.
8. Flashing materials.
9. Rainwater Reclamation System

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
   a. MIFAB, Inc.

b. Smith, Jay R. Mfg. Co.
c. Watts Water Technologies, Inc.
d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: Nominal 14-inch diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Outlet: Bottom.
7. Extension Collars: Required.
8. Underdeck Clamp: Required.
9. Dome Material: Cast iron.
10. Perforated Gravel Guard: Stainless steel.

B. Metal, Parapet Roof Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
   a. MIFAB, Inc.
   b. Smith, Jay R. Mfg. Co.
   c. Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for parapet roof drains.
3. Outlet: Back.
4. Grate Material: Cast iron.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Adaptors:

1. Description: Manufactured, gray-iron casting, for attaching to horizontal-outlet, parapet roof drain and to exterior, sheet metal downspout.
2. Size: Inlet size to match parapet drain outlet.

B. Downspout Boots:

1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
2. Size: Inlet size to match downspout and NPS 4 outlet.

C. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.3 CLEANOUTS

A. Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. Smith, Jay R. Mfg. Co.
   b. Tyler Pipe.
   c. Watts Water Technologies, Inc.
   d. Zurn Plumbing Products Group; Light Commercial Products Operation.

2. Standard: ASME A112.36.2M, for adjustable housing cast-iron soil pipe with cast-iron ferrule cleanouts.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule Material: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: Cast-iron plug.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Painted cast iron.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

B. Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
3. Size: Same as connected drainage piping.
4. Body Material: Hubless, cast-iron soil-pipe test tee as required to match connected piping.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. ProSet Systems Inc.

b. Hilti Inc
c. Tremco Sealants

2. Standard: ASTM E 814, for through-penetration firestop assemblies.
3. Certification and Listing: Insert testing agency acceptable to authorities having jurisdiction for through-penetration firestop assemblies.
4. Size: Same as connected pipe.
5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M,12 oz./sq. ft..

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

2.6 RAINWATER RECLAMATION SYSTEM

A. MANUFACTURERS
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
a. Burt Process Equipment
b. GA Fleet Associates
c. Wahaso – Water Harvesting Solutions

B. The system shall be designed to collect rainwater from the stormwater reclamation system. Water will be transferred at a rate of 30gpm at 120PSI through the water reclaim system to a 1200 gallon storage tank. The system will then pressurize to the flushing fixtures system at a rate of 68 gpm at 60 psi. One of the pumps shall recirculate the holding tank through the system again during off hours. The supply pumps will automatically alternate with each cycle. The system shall be controlled via a common PLC driven control panel with touch screen operator interface. System will require a single 460VAC, three phase power connection.

Quantity	Description
1	Water Storage Tank a) 1200 gallon capacity b) White polypropylene construction, thermally formed sidewalls and butt-welded construction with extrusion welded exterior and triple bead welded interior c) Tank shall have the following welded fittings: rainwater inlet, vent, level control mount, city water inlet, recirculation return, pump suction flanges, and drain d) Integrally welded cover with 24" access man-way
1	Level Transmitter a) Continuous, non-contact level indication b) 8"-26.2ft operating range c) +/- 0.2% of span accuracy in air d) 1 mm resolution e) PVDF transducer material, NEMA 4X housing f) 4-20mA two-wire output
2	Distribution Pump a) Multi-stage booster pump, stainless steel b) Max. fluid temperature of 180 degrees F c) Three phase motor, TEFC 7.5 HP d) Designed for min. 68 gpm @ 60 psi e) Integral VFD and padlockable disconnect f) Common adjustable pressure switch on pump discharge, NEMA 4X, 0-100 psi adjustable
1	Expansion Tank a) Welded steel construction with Butyl diaphragm b) 30 gallon capacity c) Sized for working system flow/pressure and VFD algorithm
1	Automated Discharge Valve a) Provides discharge or recirculation during off-hours b) PVC/Viton wetted parts c) 3-Way, true-union ball valve d) Electric actuator with limit switch feedback e) Double-L port ball
1	Dye Storage Tank (to water closet flush valves only) a) One-piece construction rotationally molded of linear medium or high-density polyethylene. b) Finished surface of tank shall be free as commercially practicable from visual defect such as foreign inclusions, air bubbles, pinholes, craters, crazing and cracking that will impair the serviceability of the tank. c) The tolerance of the outside diameter including out of roundness shall be +/- 3%.

d) Tank shall be 55 gallon capacity, vertical cylindrical construction with dimensions of 22" diameter x 36" tall.
e) Tank shall have 1/2" thick bolt down polypropylene cover and include factory mounting of metering pump
f) Include single point float level control for reagent low level alarm

1 Electronic Dye Metering Pump
a) Automatic control with analog input
b) Auto-Off-Manual switch
c) Built-in circuit protection against voltage and current upsets
d) Wetted parts: PVC, Ceramic, and Teflon
e) Supplied with multi-function discharge valve, suction strainer and injection check valve
f) Pulsatron model LPA2MA-VTC1 or approved equal

1 Flow Sensor for Dye Injection Control
a) Paddle Wheel Style Sensor
b) Flow Rate Range 1-20ft/s
c) Linearity of +/-1% of full range
d) Repeatability of +/-0.5% of full range
e) Signet model P51530P0 or approved equal

1 Disc filter
a) Designed for 30 gpm minimum capacity
b) Automatic backwash control
c) PLC control for proper sequencing
d) Utilizes permate filter water for backflush cycle
e) 50 micron particle control

1 T304SS UV chamber with 254 nm wavelength bulbs for sanitization on reclaimed water. Sized for 30 gpm minimum @ 50% bulb capacity.

A/R Plumbing and valves to be sch.80 PVC with Viton seals where applicable.

1 Central system control panel containing the following:
a) Three phase disconnect switch to cut power to the panel for servicing. Provided with lockout capabilities.
b) Motor protectors for recirculation pumps
c) Flow Transmitter
d) Siemens series, or approved equal, programmable logic controller (PLC) to contain ladder logic to operate the entire system.
e) Siemens graphic display package, or approved equal, including touch screen for each electric device in the system to indicate its operating status.
f) NEMA 4 electrical rating
g) UL panel labeling required
h) Adjustable alarm horn with silence button
i) All required controls and accessories for complete system operation

1 System components other than storage tank to be factory mounted and plumbed on common epoxy coated carbon steel skid.

1 Electrical conduit shall be corrosion resistant PVC with PolyTuff flexible conduit as manufactured by Hubbell or approved equal.

1 System manufacturer shall provide two days of site assistance to cover start-up and instruction of site personnel.

C. DOCUMENTATION AND OPERATING MANUALS

The equipment supplier shall furnish the following with the system, in duplicate. All documents and prints described below will be contained in the system operating manuals.

1. Plumbing process and instrumentation diagram (P&ID).
2. Electrical ladder diagrams for control panel, in accordance with accepted practices.
3. Complete bill of materials, including system sub components along with major components
4. Cross-reference between each print and the bill of materials, providing references to system components.
5. Operating and maintenance manuals containing descriptive information on the operation of the system, operating and troubleshooting information, spare parts, specification sheets and manufacturer's cut sheets and service manuals.
6. Complete ladder and logic diagram (program) loaded into PLC

D. EQUIPMENT GUARANTEE BY INSTALLER

All new components and instrumentation for the system shall be guaranteed against defects in workmanship for a period of one year from the date of shipment.

E. SEQUENCE OF OPERATIONS

1. The rainwater reclaim system accepts collected storm water and provides treated water supply for water closet flush valves.
2. Water is supplied from the building storm water reclamation system. Rainwater is pumped from the irrigation tank through the treatment skid assembly, where it passes through a back flush filter, a disinfection UV light and into the storage tank. Water is then pressured for use to an expansion tank based on a pressure setting to hold reclaim water pressure to the building.
3. The system operates in three different rainwater reclaim system service modes:
    a. Circulation Return to rainwater storage
    b. Rainwater supply to building
    c. Rainwater system standby

    d. While the system is in the normal Service mode of operation, the system will supply treated Rainwater to points of use requirements on demand. When there is no demand for reclaim water, rainwater is circulated back to the reclaim storage tank through a separate

pumped circulation line. The system is automated, and is controlled by a Main PLC Control panel (MCP) mounted on the assembly.

4. A duplexed pumping system supplies water from the reclaim storage tank to the building points of use. When there is no demand, the pumps will shut down and enter a Standby mode.
5. This pumping system consists of two multistage centrifugal pumps connected in parallel. During normal service operation, one (1) pump will operate at a time, as the pumps are automatically alternated by the PLC on a demand basis.
6. A check valve is installed on the discharge of each pump. Manual isolation valves are provided on the suction and discharge of each pump for ease of maintenance. A pressure indicator and a sample port are installed on the common pump discharge header.
7. A discharge flow sensor/transmitter monitors flow of reclaim water to the building. A Low Flow alarm condition disables the supply pumps and alerts an operator of a low flow condition when flow rate is detected below a low flow setpoint.
8. The building supply manifold from the pumps discharge consists of an expansion tank with a two-position pressure switch. A pressure indicator is installed to monitor supply pressure. During periods of Reclaim water demand to the building, the pressure switch senses that pressure in the expansion tank reaches a Low pressure setpoint . At this point, the supply pump is enabled, and flow is diverted to the building supply line. The pump remains in operation until demand is satisfied, at which point the pressure in the expansion tank reaches a High pressure setpoint. When pressure has been maintained for a preset time, the pump shuts down and remains in Standby until the next demand condition occurs.
9. The rainwater reclaim system also has the capability of entering Standby operation, where the system will shut-down after having run in Circulation without demand for a preset time interval. The system will automatically re-start and run in Circulation mode for a preset duration, then return to Standby. The system will remain in this mode of operation until the next demand signal or Standby timer occurs. Time intervals and durations are set by an operator at the HMI.
10. In the event that the tank does not have an adequate amount of water to supply the rainwater reclaim system, an automated City Water supply valve provides make-up water to the Reclaim Storage tank for supply to the building. This is controlled by water level in the interior storage tank.
11. The system is designed to restart automatically upon restoration of power after a power loss.
12. The system is supplied with a Main PLC Control Panel (MCP). The MCP is installed and wired on the assembly. A 460/3/60VAC feed circuit supply to the Main panel is required for system operation. A transformer is mounted on the skid to provide 120/1/60VAC feed circuit supply to the MCP for system controls operation.
13. The system is monitored and controlled by a PLC, which is installed in MCP. The MCP provides power directly to instruments, and to other system components. The MCP includes switches, indicator lights, an alarm silence pushbutton, an alarm horn, flow monitor, and an E-Stop and reset pushbuttons necessary for system operation. System alarms and operating parameters are indicated on the panel mounted Operator Interface Terminal (OIT), or Human Machine Interface (HMI). User adjustable system operating parameters are entered at the panel mounted flow monitor, and at the HMI.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots at grade with top 6 inches above grade. Secure to building wall.

D. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Install horizontal backwater valves in floor with cover flush with floor.

I. Install drain-outlet backwater valves in outlet of drains.

J. Install test tees in vertical conductors and near floor.

K. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

L. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with finished surface unless otherwise indicated.

M. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

N. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.

O. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plug in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 221429

SUMP PUMPS

PART 1 - GENRAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Submersible sump pumps.
   2. Wet-pit-volute sump pumps.
   3. Sump-pump basins and basin covers.
   4. Packaged drainage-pump units.

B. Related Section:
   1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of sump pumps work required for this Project, with a minimum of *3* years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

B. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

C. Manufacturer shall specialize in manufacturing the type of sump pumps specified in this section, with a minimum of *3* years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. UL Compliance: Comply with UL 778 for motor-operated water pumps.

F. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to Division 1 Specification Sections.

B. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Wiring Diagrams: For power, signal, and control wiring.

D. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

E. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions direction.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

B. Retain shipping flange protective covers and protective coatings during storage.

C. Protect bearings and couplings against damage.

D. Comply with pump manufacturer's written rigging instructions for handling.

1.7 WARRANTY

A. Comply with General Conditions.

PART 2 - PRODUCT

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or equal product by one of the following:
      a. Goulds Pumps; ITT Corporation.
      b. Grundfos Pumps Corp.
      c. Liberty Pumps.
      d. Or Approved Equal.
   2. Description: Factory-assembled and -tested sump-pump unit.
   3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
   4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
   5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron and ASTM B 584, cast bronze, design for clear wastewater handling, and keyed and secured to shaft.
   6. Pump and Motor Shaft: Stainless steel or steel, with factory-sealed, grease-lubricated ball bearings.
   7. Seal: Mechanical.
   8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

a. Motor Housing Fluid: Air.

9. Controls:
   a. Enclosure: NEMA 250, Type 1.
   b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
   e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
10. Controls:
   a. Enclosure: NEMA 250, Type 1; wall-mounted.
   b. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
   c. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
   d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
11. Control-Interface Features:
   a. Remote Alarm Contacts: For remote alarm interface.
   b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
      1) On-off status of pump.
      2) Alarm status.

2.4 SUMP PUMP CAPACITIES AND CHARACTERISTICS

A. Refers to plumbing schedules for capacities and characteristics

2.5 SUMP-PUMP BASINS AND BASIN COVERS

A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
   1. Material: Cast iron.
   2. Reinforcement: Mounting plates for pumps, fittings, and accessories.
   3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.

B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
   1. Reinforcement: Steel or cast iron, capable of supporting foot traffic for basins installed in foot-traffic areas.

C. Refers to plumbing schedules for capacities and characteristics

2.6 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Instruct City of New York's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 221429

SECTION 223400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Commercial, atmospheric, gas-fired, storage, domestic-water heaters.
2. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
3. Domestic-water heater accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Two year(s).

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-Fired, STORAGE, domestic-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bradford White Corporation.
   b. Lochinvar Corporation.
   c. PVI Industries, LLC.
   d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Lining: glass or Nickel plate complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

4. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
   g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
   h. Temperature Control: Adjustable thermostat.
   i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
   j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-

pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.
7. Automatic Damper: ANSI Z21.66/CSA 6.14-M, mechanically activated, automatic-vent-damper device with size matching draft hood.

B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. PVI Industries, LLC.
   b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Lining: Glass Nickel plate complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

4. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
   e. Jacket: Steel with enameled finish.
   f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.
   g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
   h. Temperature Control: Adjustable thermostat.
   i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
   j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-

pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

C. Capacity and Characteristics: see schedule on drawing.

2.2 domestic-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL Inc.
   b. Honeywell International Inc.
   c. Pentair Pump Group (The); Myers.
   d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   e. Taco, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 7 gal. minimum.
   c. Air Precharge Pressure: as required per heater manufacturer.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or

gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

G. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

H. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

I. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

J. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

K. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

L. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.

M. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and DDC General Conditions for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves required by code compliant installation.

C. Install oil-fired, domestic-water heaters according to NFPA 31.

1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 230523 "General-Duty Valves for HVAC Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration Controls for HVAC Piping and Equipment."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

K. Fill domestic-water heaters with water.

L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and DDC General Conditions for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 223400

This Page Intentionally Left Blank

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.3 QUALITY INSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial lavatories work required for this project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts
   1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial lavatories specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1 and Credit WE 3: Documentation indicating flow and water consumption requirements.
2. Product Data for Prerequisite WE 1: Documentation indicating flow and water consumption requirements.
3. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud, accessible: Refer to Drawing P-600

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. Kohler Co. (basis of design as per Architect)
   b. Sloan Valve Company
   c. American Standard

2. Bowl:

   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Siphon jet.
   d. Style: Flushometer valve.
   e. Height: Standard.
   f. Rim Contour: Elongated.
   g. Water Consumption: 1.6 gal. per flush.
   h. Spud Size and Location: NPS 1-1/2; top.

3. Support:

a. Standard: ASME A112.6.1M.
b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.
c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves: Refer to Drawing P-600

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. Sloan Valve Company.
   b. Kohler Co.
   c. American Standard
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

B. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Moen Incorporated.
   b. Sloan Valve Company.
   c. TOTO USA, INC.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Concealed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Kohler Co.
    c. Olsonite Seat Co.
    d. TOTO USA, INC.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closet, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Commissioner.

END OF SECTION 224213.13

SECTION 224213.16

COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.3 QUALITY INSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial lavatories work required for this project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts
   1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial lavatories specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, washout, accessible: Refer to Drawing P-600

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. Zurn Industries, LLC; Commercial Brass and Fixtures.
   b. Sloan Valve Company
   c. American Standard

2. Fixture:

   a. ZURN Z5708.207 Ultra Low Consumption Urinal (or approved equal)

   b. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   c. Material: Vitreous china.
   d. Type: Washout with extended shields.
   e. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
   f. Water Consumption: Water saving.
   g. Spud Size and Location: NPS 3/4,.
   h. Outlet Size and Location: NPS 2, back.
   i. Color: White.

3. Waste Fitting:

   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 2.

4. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.2 URINAL FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Kohler Co.
   b. Moen Incorporated.
   c. Sloan Valve Company.
   d. TOTO USA, INC.
   e. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
11. Consumption: 1/8 gal. per flush.
12. Minimum Inlet: NPS 3/4.
13. Minimum Outlet: NPS 1-1/4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install wall-hung, bottom-outlet urinals with tubular waste piping attached to supports.
4. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
5. Install trap-seal liquid in waterless urinals.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Commissioner.

END OF SECTION 224213.16

This Page Intentionally Left Blank

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.3 QUALITY INSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial lavatories work required for this project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts
   1. Work shall be performed in compliance with City of New York's requirements, and UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial lavatories specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite WE 1 , Credit WE 2, and Credit WE 3: Documentation indicating flow and water consumption requirements.
2. Product Data for Prerequisite WE 1: Documentation indicating flow and water consumption requirements.
3. Product Data for Prerequisite WE 1 and Credit WE 2: Documentation indicating flow and water consumption requirements.

C. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Division 1, include the following:

a. Servicing and adjustments of automatic faucets.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory: Rectangular, self-rimming, vitreous china, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Standard America.
b. Kohler Co.
c. TOTO USA, INC.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Self-rimming for above-counter mounting.
c. Mounting Material: Sealant.

2.2 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets, Automatic-type, battery-powered, electronic-sensor-operated, mixing, solid-brass valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Kohler Co. K-13460
   b. Chicago Faucets 116.768.AB.1
   c. Moen 8553

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Maximum Flow: 0.1 gal. per metering cycle.
10. Mounting Type: Deck, concealed.
11. Spout: Rigid type.
12. Spout Outlet: Aerator.
13. Drain: Not part of faucet.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 1/2.
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Commissioner.

END OF SECTION 224216.13

This Page Intentionally Left Blank

SECTION 22 42 16.16

COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Service basins.
2. Service sinks.
3. Utility sinks.
4. Handwash sinks.
5. Sacristy sinks.
6. Sink faucets.
7. Laminar-flow, faucet-spout outlets.
8. Supply fittings.
9. Waste fittings.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial sinks work required for this Project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial sinks specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to Division 1 Specification Sections.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.

2. Include rated capacities, operating characteristics and furnished specialties and accessories.

C. LEED Submittals:

1. Product Data for WE Prerequisite 1 , Credit WE 2, and Credit WE 3: Documentation indicating flow and water consumption requirements.

D. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of New York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

E. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Condition directions.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of New York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 SERVICE BASINS

A. Service Basins Terrazzo, floor mounted: Refer to Drawing P-600

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Acorn Engineering Company.
b. Crane Plumbing, L.L.C.
c. Florestone Products Co., Inc.
d. Stern-Williams Co., Inc.

2. Fixture:

a. Standard: IAPMO PS 99.
b. Shape: Square.
c. Nominal Size: 24 by 36 inches.
d. Height: 10 inches.
e. Tiling Flange: On two sides.
f. Rim Guard: On front top surfaces.
g. Color: Not applicable.
h. Drain: Grid with NPS 2 outlet.

3. Mounting: On floor and flush to wall.

4. Faucet: Insert sink-faucet designation from "Sink Faucets" Article.

2.4 SERVICE SINKS

A. Service Sinks Enameled, cast iron, trap standard mounted: Refer to Drawing P-600

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Commercial Enameling Company.
c. Gerber Plumbing Fixtures LLC.
d. Kohler Co.
e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2.
b. Type: Service sink with back.
c. Back: Two faucet holes.
d. Nominal Size: 24 by 20 inches.
e. Color: White.
f. Mounting: NPS 3 P-trap standard with grid strainer inlet, cleanout, and floor flange.
g. Rim Guard: On front and sides.

3. Faucet: Insert sink-faucet designation from "Sink Faucets" Article.

4. Support: ASME A112.6.1M, Type II, sink carrier.

2.5 HANDWASH SINKS

A. Handwash Sinks Stainless steel, wall mounted: Refer to Drawing P-600

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Advance Tabco.
b. AERO Manufacturing Company.
c. Amtekco Industries, Inc.
d. Eagle Group; Foodservice Equipment Division.
e. Elkay Manufacturing Co.
f. Griffin Products, Inc.
g. Just Manufacturing.

2. Fixture:

a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
b. Type: Basin with radius corners, back for faucet, and support brackets.
c. Nominal Size: 17 by 16 by 5 inches.

3. Faucet: Insert sink-faucet designation from "Sink Faucets" Article.

4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.

5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

6. Support: ASME A112.6.1M, Type II, sink carrier.

2.6 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, single-control.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Bradley Corporation.
c. Chicago Faucets.
d. Delta Faucet Company.
e. Elkay Manufacturing Co.
f. Franke Consumer Products, Inc.
g. Gerber Plumbing Fixtures LLC.
h. GROHE America, Inc.
i. Hansgrohe USA.
j. Just Manufacturing.
k. Kohler Co.
l. Moen Incorporated.
m. Speakman Company.
n. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASME A112.18.1/CSA B125.1.

3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.

4. Body Type: Centerset.

5. Body Material: Commercial, solid brass.

6. Finish: Chrome plated.

7. Maximum Flow Rate: 2.2 gpm.

8. Handle(s): Wrist blade, 4 inches.

9. Mounting Type: Deck, concealed.

10. Spout Type: Swing, solid brass.

11. Vacuum Breaker: Not required for hose outlet.

12. Spout Outlet: Aerator.

2.7 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2

2. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.8 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.

2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or steel wall flange.

3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

2.9 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Indicate on Drawings those sinks that are required to be accessible.

D. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

E. Set floor-mounted sinks in leveling bed of cement grout.

F. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

2. Install stops in locations where they can be easily reached for operation.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

I. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sink for temporary facilities unless approved in writing by Commissioner.

END OF SECTION

SECTION 224223 - COMMERCIAL SHOWERS, RECEPTORS, AND BASINS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Individual shower receptors.

2. Shower faucets.

3. Shower basins.

4. Grout.

1.3 QUALITY ASSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial showers, receptors, and basins for fire-suppression piping work required for this Project, with a minimum of *3* years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts.

1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial showers, receptors, and basinsfor fire-suppression piping specified in this section, with a minimum of *3* years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.

1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Submit the following according to Division 1 Specification Sections.

B. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.

2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

C. LEED Submittals:

1. Product Data for WE Prerequisite 1 , Credit WE 2, and Credit WE 3: Documentation indicating flow and water consumption requirements.

D. Hazardous Materials Notification: In the event no product or material is available that does not contain asbestos, PCB or other hazardous materials as determined by the City of new York, a "Material Safety Data Sheet" (MSDS) equivalent to OSHA Form 20 shall be submitted for that proposed product or material prior to installation.

E. Asbestos and PCB Certification: After completion of installation, but prior to Substantial Completion, Contractor shall certify in writing that products and materials installed, and processes used, do not contain asbestos or polychlorinated biphenyls (PCB), using DDC General Conditions procedures.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with General Conditions.

PART 2 PRODUCTS

2.1 UNAUTHORIZED MATERIALS

A. Materials and product required for work of this section shall not contain asbestos, polychlorinated biphenyls (PCB) or other hazardous materials identified by the City of new York.

2.2 ACCEPTABLE MANUFACTURERS

A. Products of the manufacturers specified in this section establish the minimum functional, aesthetic and quality standards required for work of this section.

2.3 INDIVIDUAL SHOWERS

A. Individual FRP Showers:Refer to Drawing P-600

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Aqua Glass Corporation.
b. Clarion Bathware.
c. Florestone Products Co., Inc.
d. LASCO Bathware.
e. MAAX.
f. MAAX; Aker Division.
g. Praxis Industries, LLC.; Aquarius Bathware.
h. Sterling; a Kohler company.
i. Swan Corporation (The).

2. General: FRP, accessible, shower enclosure with faucet and receptor and appurtenances.

3. Standard: ANSI Z124.1.2.

4. Type: One-piece unit without top.

5. Style: Standard residential.

6. Faucet: Insert faucet designation from "Shower Faucets" Article.

7. Nominal Size and Shape: 36 by 36 inches square.

8. Color: White.

9. Bathing Surface: Slip resistant according to ASTM F 462.

10. Outlet: Drain with NPS 2 outlet.

11. Shower Rod and Curtain: Required.

12. Grab Bar: ASTM F 446, mounted on support area back wall.

2.4 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets: Refer to Drawing P-600

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Chicago Faucets.

c. Ferguson Enterprises, Inc.; ProFlo Brand.
d. Kohler Co.
e. Lawler Manufacturing Co., Inc.
f. Leonard Valve Company.
g. Matco-Norca.
h. Moen Incorporated.
i. Powers; a division of Watts Water Technologies, Inc.
j. Speakman Company.
k. Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.

3. Faucet:

a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
b. Body Material: Solid brass.
c. Finish: Polished chrome plate.
d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
e. Mounting: Concealed.
f. Operation: Single-handle, twist or rotate control.
g. Antiscald Device: Integral with mixing valve.
h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

4. Supply Connections: NPS 1/2.

5. Shower Head:
a. Maximum 1.8 gpm flow rate shower head.
b. Standard: ASME A112.18.1/CSA B125.1.
c. Type: Ball joint with arm and flange.
d. Shower Head Material: Metallic with chrome-plated finish.
e. Spray Pattern: Fixed.
f. Integral Volume Control: Not required.
g. Temperature Indicator: Not required.

2.5 SHOWER BASINS

A. Shower Basins, Precast-terrazzo shower basin: Refer to Drawing P-600

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Crane Plumbing, L.L.C.
b. Florestone Products Co., Inc.
c. LASCO Bathware.
d. Swan Corporation (The).
e. American Standard America.
f. Florestone Products Co., Inc.
g. Kohler Co.
h. LASCO Bathware.

i. Acorn Engineering Company.
j. Bradley Corp.

2. General: Precast-terrazzo base for built-up-type shower fixture.

3. Standard: IAPMO PS 99 for precast-terrazzo material.

4. Type: Handicapped/wheelchair.

5. Nominal Size and Shape: 36 by 36 inches square.

6. Color: White.

7. Outlet: Drain with NPS 2 outlet.

8. Bathing Surface: Slip resistant according to ASTM F 462.

2.6 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball, gate, or globe valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Set shower receptors and shower basins in leveling bed of cement grout.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers and basins, inspect and repair damaged finishes.

B. Clean showers and basins, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Commissioner.

END OF SECTION

SECTION 224500

EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Eye/face wash equipment.
   2. Water-tempering equipment.

1.3 QUALITY INSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial lavatories work required for this project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts
   1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial lavatories specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: Submit certificates of performance testing.

B. Field quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

D. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.1 EYE/FACE WASH EQUIPMENT

A. Standard, Freestanding, Plumbed, Eye/Face Wash Units,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Safety; a division of Acorn Engineering Company.
b. Bradley Corporation.
c. Guardian Equipment Co.

d. Haws Corporation.
e. Speakman Company.

2. Capacity: Not less than 3.0 gpm for at least 15 minutes.
3. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
4. Control-Valve Actuator: Paddle.
5. Spray-Head Assembly: Two or four receptor-mounted spray heads.
6. Receptor: Chrome-plated brass or stainless-steel bowl.
7. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2 Include galvanized-steel indirect connection to drainage system.
8. Mounting: Pedestal.

B. Accessible, Freestanding, Plumbed, Eye/Face Wash Units,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Safety; a division of Acorn Engineering Company.
b. Bradley Corporation.
c. Encon Safety Products.
d. Guardian Equipment Co.

2. Capacity: Not less than 3 gpm for at least 15 minutes.
3. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
4. Control-Valve Actuator: Paddle.
5. Spray-Head Assembly: Two or four receptor-mounted spray heads.
6. Receptor: Chrome-plated brass or stainless-steel bowl.
7. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2 Include galvanized-steel indirect connection to drainage system.
8. Mounting: Offset pedestal.
9. Special Construction: Comply with ICC/ANSI A117.1.

2.2 WATER-TEMPERING EQUIPMENT

A. Hot- and Cold-Water, Water-Tempering Equipment, Insert drawing designation:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Safety; a division of Acorn Engineering Company.
b. Bradley Corporation.
c. Guardian Equipment Co.
d. Haws Corporation.
e. Lawler Manufacturing Co., Inc.
f. Leonard Valve Company.

g. Powers; a division of Watts Water Technologies, Inc.
h. Speakman Company.

2. Description: Factory-fabricated equipment with thermostatic mixing valve.

a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
b. Supply Connections: For hot and cold water.

B. Electric Water-Tempering Equipment,:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.

b. Haws Co.

c. Therm-Omega Technologies

2. Description: Factory-fabricated equipment with electric heating.

a. Heating System: Electric, designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, heating coils, high-temperature-limit device, metal piping, and corrosion-resistant enclosure.

1) Electrical Characteristics: 220-V ac, 40 A, single phase, 60 Hz.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."

F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

J. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."

B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 221116 "Domestic Water Piping."

C. Connect cold water and electrical power to electric heating water-tempering equipment. Comply with requirements for cold-water piping specified in Section 221116 "Domestic Water Piping."

D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

F. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 224500

SECTION 224713 - DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes drinking fountains and related components.

1.3 QUALITY INSURANCE

A. The work of this section shall be performed by a company which specializes in the type of commercial lavatories work required for this project, with a minimum of 3 years of documented successful experience and shall be performed by skilled workmen thoroughly experienced in the necessary crafts
   1. Work shall be performed in compliance with UL approvals and testing for materials, assemblies and procedures.

B. Manufacturer shall specialize in manufacturing the type of commercial lavatories specified in this section, with a minimum of 3 years of documented successful experience, and have the facilities capable of meeting all requirements of Contract Documents as a single-source responsibility.

C. Manufacturer's identification tags or marks are not acceptable on surfaces which will remain exposed to view after installation.
   1. Evidence of "patching" after removal of tags or marks is not acceptable.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include operating characteristics, and furnished specialties and accessories.

B. LEED Submittals:

   1. Product Data for Prerequisite WE 1 and Credit WE 3: Documentation indicating flow and water consumption requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains: Stainless steel, wall mounted: Refer to Drawing P-600

1. Stainless-Steel Drinking Fountains:

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Elkay Manufacturing Co.
2) Filtrine Manufacturing Company.
3) Halsey Taylor.
4) Haws Corporation.

2. Drain: Grid type with NPS 1-1/4 tailpiece.
3. Supply: NPS 3/8 with shutoff valve.
4. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
5. Support: ASME A112.6.1M, Type III lavatory carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains on floor.

C. Install recessed drinking fountains secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixture.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Commissioner.

END OF SECTION 224713

SECTION 23 00 10

MECHANICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 DESCRIPTION

A. Furnish all labor, services, materials, tools, equipment, appliances, facilities, transportation and incidental work and appurtenances required to furnish a complete and properly operating system.

B. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and shall coordinate the work with that of the other trades to avoid interference. The plans are diagrammatic and show the general arrangement of the fixtures, equipment, piping and ductwork. All dimensions and existing conditions shall be the responsibility the Contractor. Before proceeding with work check and verify all dimensions.

C. The Contractor shall assume all responsibility for fitting of materials and equipment to other parts of equipment and structure. Make adjustments that may be necessary or as requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation, of existing pipes, conduits and/or ducts.

D. Where the project involves interface with existing building and site systems, the Commissioner has used reasonable care to identify existing utilities and services. The Contractor is responsible to thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available i.e. concealed conditions, which exist in the existing building affected by this work.

E. Documents do not represent to show or list every item to be provided. When an item not shown or listed, is necessary for proper operation of the system and/or equipment, the Contractor shall provide the item which will allow the system to function properly at no increase in Contract Sum.

F. Work shall include, but shall not be limited to, the following:

1. Coordinate maintenance of existing services during construction with City of New York.
2. Special coordination of chases and plenums.
3. Hoisting and rigging required to complete work of this section.
4. Sleeves, inserts and hangers.

5. Flexible connections for pumps and other vibrating and rotating equipment.
6. Equipment bases and supports.
7. Vibration isolators, seismic restraints and inertia blocks.
8. Motors.
9. Complete hot water system including pumps, expansion tanks, piping, valves, fittings and other hardware.
10. Complete dual temperature water system including pumps, expansion tanks, piping, valves, fittings and other hardware.
11. Expansion joints, anchors and guides.
12. Pressure gauges and thermometers.
13. Water treatment equipment and chemicals, and testing.
14. Radiant systems such chilled beams, radiant ceilings and radiant floors.
15. Sheet metal work.
16. Complete air distribution system including low and medium pressure ductwork, diffusers, registers, grilles, dampers, etc.
17. Insulation for duct, piping, equipment and tanks.
18. Air handling units, including fans, filters, motors, and mixing boxes.
19. Air volume terminal boxes.
20. Sound Attenuators.
21. Exhaust and ventilating air fans.
22. Rooftop supply and exhaust fans.
23. Condensate piping from chilled water coil drain pans.
24. Unit heaters.
25. Cabinet heaters.
26. Prime painting.
27. Pipe, duct, valve and equipment identification.
28. Instruction manual and start up instructions.
29. Testing and balancing.
30. Commissioning.
31. Cleaning.
32. Automatic temperature controls, air volume controls and other controls.
33. Power wiring to all DDC control panels and controls.

G. Related work specified elsewhere: The following work, unless otherwise noted is not included in this section shall be performed in other sections:

1. Electric power wiring for all equipment. See division 26.
2. Provision of circuit breakers testing and connections for DDC control power wiring.
3. Gypsum drywall enclosures of supply and return ductwork on all rooftop air handlers, supply and return shafts, as shown on drawings.
4. Excavation and backfill.
5. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment, duct bank envelopes and cast in place manholes and handholes, except as part of an inertia base. See Division 3
6. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal deck.
7. Flashing of wall and roof penetrations.
8. Installation of access panels in floors, walls, furred spaces or above ceilings
9. Outdoor air intake and exhaust louvers.
10. Undercutting of doors and door louvers
11. Partitions and Painting (except as specifically indicated) See Division.
12. Structural supports necessary to distribute loading from equipment to roof or floor, except as specified herein.

13. Foundation drainage systems and site drainage structures.
14. Paving
15. Thermal and sound insulation in partitions and ceilings.

1.3 QUALITY ASSURANCE

A. General:

1. All equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
2. All equipment and accessories shall be new and free from defects.
3. Supply all equipment and accessories in compliance with the applicable standards listed in this Section and with all applicable National, State and Local Codes.
4. All items of a given type shall be the product of the same manufacturer.
5. The subcontractor must, within the last three years, prior to the bid opening, have successfully completed in a timely fashion projects similar in scope and type to the required work.

B. Requirement of regulatory agencies:

1. In accordance with requirements of DDC General Conditions and as specified herein.
2. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
3. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules or regulations, Drawings and Specifications take precedence.
4. It is not the intent of Drawings and Specifications to repeat requirements of codes except where necessary for completeness or clarity.
5. If any of the requirements of the above are in conflict with one another, or with the requirements of these specifications, the most stringent requirements shall govern, or direction given at the discretion of the City of New York.
6. NY State code and all other apposite standards and codes, including LEED requirements.

C. LEED General Requirements

1. This Project is targeting Certification under USGBC's LEED Green Building Rating System. The contractor, subcontractor, vendors, material suppliers and manufacturers performing work on this Project shall ensure that the requirements related to these goals, as defined in the sections below, are implemented fully.
2. Substitutions, or other changes to the work, proposed by the contractor, subcontractor, vendors, material suppliers and manufacturers performing work on this Project shall not be allowed if such changes to this specification section may compromise the attainment of any points under any credits on the Project's LEED Checklist.

D. Green Building Performance Requirements

1. The Contractor shall implement practices and procedures to meet the Project's GREEN BUILDING requirements. The Contractor shall ensure that the requirements related to

these goals, as defined in Section 01 81 13: "Sustainable Design Requirements, and as specified in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be proposed by the Contractor or their sub-contractors if such changes compromise the stated GREEN BUILDING Performance Criteria.

2. VOC Limits: All field-applied adhesives, sealants, primers, paints and coatings used on the interior of the building shall meet the volatile organic compound (VOC) and chemical component limitations as defined in Section 01 81 13.13 "Volatile Organic Compound Limits", VOC contents shall be identified and documented.

3. Elimination of CFCs and HCFCs:

   a. Ozone Protection: Building cooling equipment shall contain no refrigerants other than the following: HCFC-123, HFC-134a, HFC-245fa, HFC-407c, or HFC 410a.
   b. Fire suppression systems may not contain ozone-depleting substances such as halons, CFCs or HCFCs. Any extruded polystyrene insulation (XPS) and closed-cell spray foam polyurethane insulation shall not be manufactured with hydrochlorofluorocarbon (HCFC) blowing agents.

1.4 DEFINITIONS

A. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

B. "Below Grade": Buried in the ground or embedded in concrete slab on ground.

C. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

D. "Connect": Complete hook-up of item with required service.

E. "Exposed": Not installed underground or "concealed."

F. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

G. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

H. "Wiring": Raceway, fittings, wire, boxes and related items.

I. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

J. Reference by abbreviation may be made in the specifications and the Contract Drawings for Mechanical and Electrical Work in accordance with the following list:

HVAC	Heating, Ventilating and Air Conditioning
AC	Air Conditioning

H&V	Heating and Ventilating
AWG	American Wire Gauge
BWG	Birmingham Wire Gauge
USS	United States Standards
B&S	Brown and Sharpe
OS&Y	Outside Screw and Yoke
IBBM	Iron Body Brass Mounted
WSP	Working Steam Pressure
PSIG	Pounds Per Square Inch
PRV	Pressure Reducing Valve
GPM	Gallons Per Minute
MBH	Thousand BTU per Hour
BTU	British Thermal Units
WG	Water Gage
LB	Pound (Also shown as: #)
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
ABMA	American Boiler Manufacturer's Association
ASA	American Standards Association

1.5 SUBMITTALS

A. This paragraph supplements the DDC General Conditions.

B. Schedule: Incorporate shop drawing review period into construction schedule so that Work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following review time requirements into his project schedule. Working days listed reference the time in Commissioners' office. It does not include transmittal time or review time of Contractor or the Commissioner. Allow at least 10 working days, exclusive of transmittal time, for review each time shop drawing is submitted or resubmitted with the exception that 20 working days, exclusive of transmittal time, are required for the following:

1. HVAC temperature control submittals.
2. HVAC balancing report.
3. Coordination Drawings.
4. If more than five shop drawings of a single trade are received in one calendar week.

C. List of Proposed Equipment and Materials:

1. Within four weeks of Award of Contract and before ordering materials or equipment, submit complete list of materials and equipment and indicate manufacturer's name, addresses and telephone numbers. No consideration will be given to partial lists submitted out of sequence.

2. If the List of Materials and Equipment is not received within the prescribed time limit, provide the first-named manufacturer for all material and equipment on this project.

1.6 COORDINATION DRAWINGS:

A. A single set of coordination drawings shall be mutually prepared by all mechanical and electrical trades.

B. The initiation of these drawings begins with Sheet Metal Subcontractor.

C. The Sheet Metal Subcontractor shall prepare a complete set of electronic background drawings at scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheet metal layout thereon. These will be Coordination Drawings.

D. Each of the mechanical, electrical and other specialty trade shall add its work to these background drawings with appropriate elevations and grid dimensions. Specialty trade information is required for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.

E. Each specialty trade shall sign and date each coordination drawing. Return drawing to the Sheet Metal Subcontractor, who shall route them sequentially to all specialty trades.

F. Where conflicts occur with placement of materials of various trades, the Sheet Metal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by specialty trade. The Sheet Metal Subcontractor shall then final date and sign each drawing. If he cannot resolve conflicts, the decision of the Contractor or Commissioner shall be final.

G. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.

H. Sheet Metal Subcontractor shall make prints of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Commissioner and have been reviewed and approved.

I. The review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with the other trades, structural and other work.

J. After review:

1. After review of coordination drawings, the method used to resolve interferences not previously identified shall be as in "MODIFICATIONS IN LAYOUT" above.
2. All changes to reviewed coordination drawings shall be in writing by the Commissioner prior to start of work in affected area.

K. ALL FIREWALLS AND SMOKE PARTITIONS SHALL BE HIGHLIGHTED ON COORDINATION DRAWINGS FOR APPROPRIATE COORDINATION.

L. The main paths of egress and for equipment removal from main mechanical and electrical rooms must be clearly shown on coordination drawings.

M. Coordination Drawings shall include, but not limited to:

1. Plumbing systems, piping and equipment.
2. HVAC piping, systems and equipment.
3. Control systems.
4. Electrical distribution, systems and equipment.
5. Lighting systems and fixtures.
6. Sheet metal work, components and accessories, costs and boxes in terminals, etc.
7. Fire protection and sprinkler system, piping and heads.
8. Structural.
9. Electrical Equipment Room layouts.
10. Environmental Rooms and associated refrigeration/heating systems.
11. Partition/room layout.
12. Ceiling tile and grid.
13. Access panels.
14. Smoke and fire dampers.
15. Roof drain piping.
16. Major electrical conduit runs, panel-boards, feeder conduit and racks of branch conduit.
17. Above ceiling miscellaneous metal.
18. Heat tracing of piping.
19. Minimum access space requirements for all equipment for both installation and maintenance.

1.7 ACOUSTICAL COMPLIANCE FOR AIR HANDLING EQUIPMENT, PUMPS, FANS, COOLING TOWERS, AND EXHAUST SYSTEMS

A. Contractor shall provide provision to bring on board, at contractor cost and no cost to the City of New York, the service of an Acoustical Engineer for evaluation of submitted units (outdoor equipment or indoor equipment) and system exposed to ambient surrounding and noise level criteria set forth by the local code and law.

B. Contractor shall achieve noise level compliance and provide potential alteration(s) in the submissions of the equipment for noise level compliance installation.

C. Contractor shall demonstrate that the installation of any equipment in communication with outdoor shall comply with Local Law and regulations.

D. Contractor shall provide ambient noise level testing and report to establish the existing noise level at the site prior to new construction. Contractor shall also provide noise level testing upon completion of the installation for final acceptance by Commissioner.

1.8 OPERATING AND MAINTENANCE MANUALS

A. All information shall also be provided in electronic PDF format. Divide the manuals into three sections or books as follows:

B. System General Description and Information. Section shall include a general description of the systems used and contain names and addresses of manufacturers and local representatives who stock or furnish or repair parts for items or equipment. List of all major equipment as installed and include model number, capacities, nameplate data and manufacturer's location and purchase order information. Include in the manuals, parts catalogs for each item of equipment furnished with the components identified by number for replacement ordering. This section shall also include:

1. Letters from manufacturers certifying their supervision of equipment installation and startup procedures as required.
2.
3. Machinery vibration test reports.
4. Certificates of piping system cleaning and chemical treatment.
5.
6. Equipment test certificates.

C. Operation, Start-up and Shutdown Procedures. Section shall include directions for and sequence of operation for each item of the Mechanical and Electrical systems; e.g., air handling units, boilers, chillers, domestic water pump, generator, etc. Sequence list shall list valves, switches, and other devices used to start, stop and control system. Include detailed approved control diagrams and flow diagrams of each air and hydronic system. Include approved valve directory showing each valve number, location of each valve, and equipment or fixture controlled by valve. Provide a motorized and manual damper charts organized on a room and by system basis, detailing and damper number.

D. Problems, Solutions and Troubleshooting. Section shall include detailed procedures to be followed in case of equipment or system malfunctions. Include manufacturer's printed troubleshooting procedures into the operating manual for reference.

E. Preventative Maintenance. Section shall include preventative maintenance requirements and schedule for each piece of equipment. This shall include lubrication instructions detailing type of lubricant, amount and intervals recommended by manufacturer for each item of equipment. A lubrication chart listing each item of equipment, all points of lubrication, lubrication type and lubrication schedule.. Include additional instructions necessary for implementation of preventative lubrication program. In addition provide additional preventative maintenance procedures concerning routine maintenance, draining of coils, belt sizes, types and adjustment tension etc. required in order to properly operate equipment.

F. Diagrams and Charts.

1. One copy of each valve chart, damper chart, and lubrication chart shall be mounted under glass and installed at locations to be selected by the City of New York.

2. Provide control diagrams, for each air and hydronic system, suitably framed, with glass front. Diagrams shall show complete equipment, controls, model numbers, etc., marked to correspond to identification on equipment. Locate as directed by City of New York.

3. Air and water flow diagrams.

In addition to the above provide all information in electronic media.

1.9 FIELD ADJUSTMENT TO AIR HANDLING EQUIPMENT, PUMPS, AND FANS

A. Contractor shall be responsible for changing or adjusting belts, drives, pulleys, motors, impellers, etc., as required, by adjustment for acoustic performance, and by balancing company to achieve the desired air and water delivery by all air handling equipment and pumps.

1.10 COOPERATION BETWEEN TRADES

A. Cooperate with all other Divisions performing work on this project as necessary to achieve a complete neatly fitted installation for each condition. Consult the Drawings and Specifications to determine nature and extent of work specified in other Divisions that adjoins or attaches to the work of this Division. Confer with other Divisions at the site to coordinate this work with theirs in view of job conditions to the end that interferences may be eliminated and that maximum head room and clearance may be obtained. In the event that interferences develop, the Commissioner's decision will be final as to which Division shall relocate its work, and no additional compensation will be allowed for the moving of piping, ductwork, conduit, or equipment, to clear such interferences. Provide templates, information, and instructions to other divisions to properly locate holes and openings to be cut or provided

B. For Testing and Balancing of the system, ensure full co-ordination between the Testing and Balancing subcontractor and all other Trades to achieve access to all system components, including leaving wall/ceiling sections down for access. HVAC Contractor shall be responsible for pre-balancing checks and check sheet and responsibilities outlined in Sections 230593 & 230800.

C. Ensure full co-ordination between controls subcontractor and Testing and Balancing subcontractor to ensure the system is commissioned in accordance with the complete requirements of the complete contract documents.

1.11 HOIST, RIGGING, TRANSPORTATION AND SCAFFOLDING

A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for placing all materials and equipment in their proper places in the Project.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction.

B. Completely cover motors and other moving machinery to protect from dirt and water during construction.

C. Cap all openings in pipe and ductwork daily to protect against entry by foreign matter.

D. Protect premises and Work of other Divisions from damage arising out of installation of Work of this Division.

E. Perform Work in manner precluding unnecessary fire hazard.

F. All ductwork shall be delivered to site with all ends and openings capped with minimum of heavy gauge polyethylene sheeting taped all around to prevent ingress of moisture, dust, debris, etc.

G. All stock piled conduit and piping shall be placed on dunnage, and protected from weather and from entry of foreign material. All stored materials and equipment shall be carefully inspected prior to installation and replaced with new material or equipment if found to be damaged, corroded, etc.

1.13 GUARANTEE AND 24 HOUR SERVICE

A. In addition to guarantee requirements of the DDC General Conditions and of Paragraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in City of New York's name.

B. Replace material and equipment that require excessive service during guarantee period as defined and as directed by the Commissioner.

C. Provide 24 hour service beginning on the date of substantial completion and lasting until the termination of guarantee period. Service shall be at no cost to City of New York.

D. At end of guarantee period, transfer manufacturer's equipment and warranties still in force to City of New York.

E. This paragraph shall not be interpreted to limit City of New York's rights under applicable codes and laws under this Contract.

F. Part 2 Paragraphs of the Specification sections may specify warranty requirements that exceed those of this Paragraph.

G. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of work nor beneficial use by City of New York, and shall not institute guarantee period.

H. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to City of New York's satisfaction, advise the Commissioner in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Commissioner will suggest course of action.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment and materials shall be as described in the respective Sections of Division 23 and Division 26 and as shown.

2.2 MATERIALS

A. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified. And or/as required to provide a fully operational installation.

B. All items of materials in each category of equipment shall be of one manufacturer.

C. Material and Equipment–General Requirements:

1. New.
2. Testing agency labeled or with other identification wherever standards have been established.
3. Commissioner reserves right to reject items not in accordance with Specification either before or after installation.
4. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design.
5. Compatible with space allocated. Modifications necessary to adjust items to space limitations at Contractor's expense.
6. Installed fully operating and without objectionable noise or vibration.

2.3 FLAME-SPREAD AND SMOKE-DEVELOPED PROPERTIES OF MATERIALS

A. All materials and adhesives used throughout the mechanical systems shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke-developed rating not higher than 50. Materials include but not limited to are insulation, acoustical lining, filter, ducts, flexible connections, jackets or coverings regardless of kind, etc. If such materials are to be applied with adhesives and the adhesives used shall have a flame-spread rating not over 25 and a smoke developed rating not higher than 50.

B. "Flame Spread Rating" and "Smoke Developed Rating" shall be as determined by the "method of test of surface burning characteristics of building materials, NFPA no. 244, ASTM E84, Underwriters' Laboratories, Inc., Standard." Such materials are listed in the Underwriters' Laboratories, Inc., "Building Materials List" under the heading "Hazard Classification (Fire)."

PART 3 -EXECUTION

3.1 COMMISSIONING OF EQUIPMENT AND SYSTEMS

A. General

1. Completion of startup and commissioning shall be accomplished as a prerequisite for substantial completion and shall be completed for each phase of construction.

2. Operate and service systems and equipment until final acceptance by Commissioner.

3. All guarantees and warranties shall not begin until final acceptance of the systems and equipment by the Commissioner. Acceptance requires, at a minimum complete systems and commissioning.

4. The City of New York maintains the right to have access to the entire project site to develop his own operational procedures.

B. Comprehensive Work Plan and Reporting

1. Provide detailed, methodical, scheduled, start up and commissioning procedures and execution of same and every system and piece of equipment provided.

2. Attend start up and commissioning meetings on a regular basis, as directed by the Contractor or Contractor.

3. Develop and provide a written work plan with detailed procedures for this work and submit, using shop drawing submittal procedure, within 6 weeks of the contract award. The work plan shall include provisions for an integrated start up plan and schedule. The plan and schedule shall identify tasks, start and completion dates, critical path items, interface requirements with other trades and major equipment start up, as minimum requirements of the plan. The plan and schedule shall clearly identify work in each construction phase, as well.

4. The purpose of this work plan is to provide for smooth, quick, and efficient start up and commissioning of systems and equipment and for a smooth transition to turn the complete, correctly operating building over to the City of New York, at each phase of construction.

5. The City of New York and the Commissioner will have input to and be part of approval process for startup and commissioning plan.

6. Develop and submit for approval a specific start up, check out and sign off form for every piece of major equipment.

7. Develop and submit for approval a specific start up, check out and sign off form for every piece of major system.

8. Systems shall be operated under actual or simulated full load conditions. Identify the operating conditions in the work plan.

9. Work plan shall incorporate the below specified "Demonstration of Successful Operation"

10. The Commissioner/City of New York may check the completed and commissioned installation either sequentially as different parts are completed, and/or when the entire installation is complete, at sole option of the Commissioner/City of New York.

11. Contractor shall arrange that an officer of his contracting company shall certify that each and every system has been tested. At the conclusion of the tests, this contractor shall submit a letter and enclosed commissioning forms signed by the officer stating:

That he is the officer of the company.
That he certifies that the specified testing of the systems has been performed by the company (give the name and dates of system testing).

The results of testing as compared to specified performance, listing the name, title, and company affiliation of all those witnessing and performing these tests.

C. Commissioning

1. Please refer to Section 230800.

2. Commission equipment and systems in accordance with the approved work plan, completing the startup, check out and sign off forms for each piece of equipment and each system.

3. Provide qualified personnel, equipment, apparatus and services for startup and testing of equipment and systems, to obtain the performance shown in schedules, as specified or on commissioning forms, and as required by codes, standards, regulations and authorities having jurisdiction including Municipal Inspectors, City of New York and Commissioner.

4. Start up and testing procedures as may be outlined in various mechanical and electrical sections of the specifications are the minimum effort required for the project. Contractor shall use any additional procedures he feels will be necessary to properly start up and test the systems and equipment actually installed on the job at no additional cost to the City of New York.

5. Provide capacity and performance of equipment by field testing. Install thermowells and gauge connections and, at no additional cost to City of New York, equipment and instruments required for testing.

6. Qualified representative of equipment manufacturer shall be present at test.
7. For each piece of equipment, copy nameplate data and include with the letter and start up, check out and sign off forms referred to above.

8. Do not cover or conceal work before testing and inspection and obtaining approval.
9. Leaks, damage and defects discovered or resulting from startup and testing shall be repaired or replaced by this contract to like-new condition with acceptable materials. Tests shall be continued until system operates without adjustments or repairs.

D. Demonstration of Successful Operation: After all components and every system has been completely commissioned, provide a two week, 24 hour per day fully functional automatic operation period of all systems simultaneously. This shall be successfully concluded before systems are accepted by the City of New York.

3.2 SPECIAL RESPONSIBILITIES:

A. Cooperate and coordinate with work of other Sections in executing work of this Section.

1. Perform work such that progress of entire project including work of other Sections shall not be interfered with or delayed.

2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.

3. Obtain detailed installation information from manufacturers of equipment provided under this section.

4. Obtain final roughing dimensions or other information needed for complete installation of items furnished under other Sections or by City of New York.

5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information on proper time, provide cutting and patching or have same done, at own expense and to full satisfaction of Commissioner.

6. Provide information as requested as to sizes, number and locations of housekeeping pads necessary for floor mounted vibrating and rotating equipment provided under this Section.
7. Notify Commissioner of location and extent of existing piping, conduit, ductwork and equipment that interferes with new construction. In coordination with and with approval of Commissioner, relocate piping, ductwork and equipment to permit new work to be provided as required by Contract Documents. Remove non-functioning and abandoned piping, ductwork and equipment as directed by Commissioner. Dispose of or store items as requested by Commissioner.

B. Installation Only Items

1. Where this contractor is required to install items which it does not purchase, it shall coordinate delivery and be responsible for their unloading from delivery vehicles and for their safe handling and field storage up to time of installation. This trade shall be responsible for:

a. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt to Commissioner's and structural conditions.

b. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

2. Contractor shall carefully examine such items upon delivery. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of contractor will be considered only if presented in writing within one week of their date of delivery. Unless such claims have been submitted contractor shall be fully responsible for the complete reconditioning or replacement of the damaged items.

C. Service of equipment and systems: Service equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

D. Use of premises: Use of premises shall be restricted as directed by the Commissioner and as required below:

1. Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of the Commissioner.

2. Store materials in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets of racks and covered with tarpaulins.

3. Do not interfere with function of existing sewers and water and gas mains, electrical or mechanical systems and services. Extreme care shall be observed to prevent debris from entering pipe, ductwork and equipment. Confer with the Commissioner as to the disruption of services or other utilities due to testing, connection of new work to existing. Interruption of services shall be performed at time of day or night deemed by City of New York to provide minimal interference with normal operation. Obtain City of New York's approval of the method proposed for minimizing service interruption.

E. Surveys and Measurements:

1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.

2. In event of discrepancy between actual measurements and those indicated, notify the Commissioner in writing and do not proceed with work until written instructions have been issued by the Commissioner.

F. Fireproofing:

1. Clip, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, insofar as possible prior to start of spray fiber work.

2. Ducts, piping and other items which would interfere with proper application of fireproofing shall be installed after completion of spray fiber work.

3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be shall be performed by installer of fireproofing and paid for by the trade responsible for damage and shall not constitute grounds for an extra to City of New York.

G. Temporary Utilities:

1. Refer to DDC General Conditions regarding requirements.

2. Coordinate work under this Section with progress of construction so that permanent heating system will be ready for temporary heating if permitted by the Commissioner as soon as the building is closed in.

3. Provide and direct labor required for attendance, operation and final restoration of permanent heating system if used for temporary heating purposes. Continuous direct attendance shall be provided whenever permanent system is in operation prior to acceptance of permanent heating system by City of New York.

H. Air bound Systems: If, after the plant is in operation, any piping systems, coils or other apparatus are stratified or air bound (by vacuum or pressure), they shall be re-piped with new approved and necessary fittings, air vents, or vacuum breakers at no extra cost. If connections are concealed in furring, floors or ceilings, this trade shall bear the cost of tearing up and refinishing construction and finish, leaving same in as good condition as before it was disturbed.

I. Miscellaneous: Unload materials and equipment delivered to site. Pay cost for rigging, hoisting, lowering and moving electrical equipment on and around site, in building or on roof.

3.3 MATERIAL AND WORKMANSHIP

A. Work shall be neat and rectilinear. Ductwork, piping, conduit, etc. shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Install material and equipment to comply with manufacturers. Recommended Requirements. Rough Work will be rejected. Installation shall operate safely and without leakage, undue wear, noise, vibration, corrosion or water hammer. Work shall be properly and effectively protected, and pipe and duct openings shall be temporarily closed to prevent obstruction and damage before completion.

B. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents.

C. Finish of materials, components and equipment shall be as approved by the Commissioner and shall be resistant to corrosion and weather as necessary.

3.4 CONTINUITY OF SERVICES

A. Subcontractor shall coordinate any shutdowns of existing systems as follows:

1. Give proper notice to City of New York when making shutdowns; a minimum of fourteen full days are required.
2. Minimize shutdowns of any system.
3. Provide temporary services where required and perform shutdown and tie-ins at a time convenient to City of New York.
4. Subcontractor shall be responsible for completing and filing City of New York's shutdown notice questionnaire.
5. Perform required survey and inspection work required by the notice for shutdown.

3.5 ANCHORS AND INSERTS:

A. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation. Insert shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

B. Provide anchors as necessary for attachment of equipment support and hangers.

3.6 ESCUTCHEONS

A. Install escutcheons around exposed pipe passing through finished floor, floor, wall, or ceiling. Escutcheons shall be heavy cast brass, chromium plated, adjustable, and of sufficient outside diameter to cover sleeve opening and shall fit snugly around pipe and flush against floor or wall surface. Escutcheon plates shall be provided on pipes at fixtures and shall be polished chrome plated. Plated steel escutcheon plates are not acceptable. Sample escutcheon plates shall be submitted to the Commissioner for approval prior to installation.

3.7 CORE DRILLING

A. Core drilling is to be avoided.

B. Set sleeves prior to installation of structure for passage of pipes, conduits, ducts, etc.

C. Where core drilling is unavoidable, or required by renovation projects, locate all required openings prior to coring and submit to the Commissioner for review.

D. Coordinate openings with Contractor/Contractor and all other trades.

E. Core drilling is to be provided by the Contractor for General Construction and not by the M/E subcontractors.

F. Do not disturb existing systems.

G. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.8 CUTTING AND PATCHING:

A. Complete cutting and patching in accordance DDC General Conditions, and as follows.

B. Provide all sleeves, core drilling, carpentry, cutting and patching required for proper installation of material and equipment specified in this Division.

C. Do not cut or drill structural members without written approval of Commissioner.

D. No cutting or patching should be done without first receiving the Commissioner's written approval.

E. Any damage caused by cutting and patching shall be restored to the original condition as required by the Commissioner.

3.9 VIBRATION CONTROL:

A. Coordinate with DDC General Conditions.

B. Design criteria for all the Work of Division 23 shall be as specified in 230548.

3.10 WATERPROOF CONSTRUCTION:

A. Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashing at exterior wall and roof penetrations. Caulk watertight penetrations of foundation walls and floors. Provide membrane clamps at penetrations of waterproof membranes.

B. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rainwater. This requirement applies to damper operators and bearing, damper motors, controls, and instruments. See other paragraphs in this Division for application of this requirement to motors, drive, ducts, and fans.

3.11 RESTORATION OF DAMAGE:

A. Repair or replace, as directed by the Commissioner and/or Commissioner, materials and parts of premises which become damaged as result of installation of Work of this Division. Remove replaced parts from premises.

3.12 LINTELS

A. Where openings break into an already completed wall as a result of a failure to set sleeves or provide openings during erection of the wall, the Contractor shall provide lintels as required for the support of building construction above the inserted item.

B. Lintels shall be structural steel angles, channels or tees of proper size and sections for the supported load; submit to the Commissioner with supporting calculations for approval prior to the installation.

C. Where new openings are required in an existing wall; coordinate opening size, location and lintel type with Commissioner.

3.13 ROOF OPENINGS AND CURBS

A. Roof openings where required shall be coordinated with the other affected trades and all flashing and patching shall be as per details indicated on the Bid Drawing Set.

3.14 TOOLS AND EQUIPMENT

A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the Work.

3.15 ADJUSTMENTS

A. Preliminary Operation:

1. Operate any portion of installation for City of New York's convenience if so requested by Contractor. Such operation does not constitute acceptance of Work as complete.

B. Startup Service:

1. Prior to startup, ensure that systems are ready, including checking the following: proper equipment rotation, proper wiring, auxiliary connections, lubrications, venting fan balance, controls and installed and properly set relief and safety valves.

C. Start and operate all systems. Provide services of factory trained technicians for startup of major equipment and systems including chillers, boilers, pumps, air handling units, etc.

D. Adjusting:

1. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.

2. Thereafter, as a result of system operation or as directed by Commissioner, make readjustments as necessary to refine performance and to effect complete system "tune-up".

3. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions for 72 hours continuously and show specified performance.

4. If, in the opinion of the Commissioner, performance of equipment or systems is not in accordance with specifications or submitted data, alter or replace equipment at no increase in Contract Sum. The Contractor, at his option, may order tests from an independent approved laboratory to prove compliance. All such tests shall be at no increase in Contract Sum. Repeat process as often as required.

5. At completion of Work, provide written certification that all systems are functioning properly without defects.

E. Noise:

1. Cooperate in reducing any objectionable noise or vibration caused by mechanical systems to the extent of adjustments to specified and installed equipment and appurtenances.

2. Cooperate in adjustment of mechanical systems and terminal devices, as directed by Commissioner, to obtain specified acoustic properties.

3. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no increase in Contract Sum. Includes refinish walls, floors etc.

3.16 INSTALLATION OF EQUIPMENT

A. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work.

B. Assemble equipment required to be field assembled under the direct supervision of the manufacturers' agent. Prior to the final acceptance submit letters from the manufacturers that this has been done.

C. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to the satisfaction of the Commissioner and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.

D. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof mounted equipment shall be installed and supported on structural steel provided under other Sections.

E. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall of ceiling mounting of equipment as required.

F. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.

G. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installations.

H. Structural steel and hardware shall conform to Standard specifications of ASTM; use of steel and hardware shall conform to requirements of Section V of Code of Practice of American Institute of Steel Construction.

I. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly, which will void warrantee. Report in writing to the Commissioner, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.

3.17 PAINTING

A. Equipment installed shall have shop coat of non-lead gray paint. Hangers and supports shall have one coat of non-lead primer. Machinery such as pumps, fans, etc., shall be stenciled with equipment name. Stencil shall be at least 6" high for large equipment, 2" high for small equipment. Finish painting, including painting of various piping and duct systems, shall be done under other Sections.

B. Paint all outside exposed equipment and equipment supports with two coats of weather resistant enamel.

C. Provide heat resistant paint for hot piping, equipment and materials.

D. Properly prepare Work under this Division to be finish painted under Division 9.

E. Refer to standard paint colors for all Mechanical, Electrical equipment inside the Building.

3.18 LUBRICATION

A. Lubricate all equipment at completion of Work. Furnish City of New York with a written lubrication schedule for all equipment as specified in DDC General Conditions and Division 23.

3.19 FINAL JOBSITE OBSERVATION

A. As the work nears completion, the Contractor is to review the requirements of the Contract Documents, inspect the work and inform all parties involved of the work to be corrected or completed before the project can be deemed substantially complete.

B. When the Project is substantially complete, In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation. Notify the Commissioner in writing of this fact, listing any items of Work remaining incomplete, the reason therefore, and the anticipated date that all remaining work will be completed. The Contractor shall inform the certification that the project is complete and ready for a final punch, the Contractor shall sign the attached certification and return it to the Commissioner so that the final observation can be scheduled.

C. The Contractor shall carry out their own final inspection and satisfy the Work.

D. The Commissioner reserves the right to cancel and reschedule the inspection in the event considerable more work remains to be completed or corrected than indicated in the written request for inspection.

E. All items not completed or found not complying with drawings or specifications by the Commissioner will be identified in their inspection report.

F. Correct all items on inspection report. Make the correction and initial and date each item on the report after corrections have been completed.

G. Include the fee for all local inspections.

3.20 INSTRUCTING THE CITY OF NEW YORK

A. Adequately instruct the City of New York's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the City of New York's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The City of New York has the option to video tape all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Explanation of all air handling systems.
3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
4. Maintenance of equipment.
5. Smoke control systems.
6. Start-up procedures for all major equipment.
7. Explanation of seasonal system changes.
8. Description of emergency system operation.

END OF SECTION 23 00 10

SECTION 230130.51

HVAC AIR-DISTRIBUTION SYSTEM CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the `Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes cleaning HVAC air-distribution equipment, ducts, plenums, and system components.

1.3 DEFINITIONS

A. ASCS: Air systems cleaning specialist.

B. NADCA: National Air Duct Cleaners Association.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For an ASCS.

B. Strategies and procedures plan.

C. Cleanliness verification report.

1.5 QUALITY ASSURANCE

A. ASCS Qualifications: A certified member of NADCA.

1. Certification: Employ an ASCS certified by NADCA on a full-time basis.
2. Supervisor Qualifications: Certified as an ASCS by NADCA.

B. UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.

C. Cleaning Conference: Conduct conference at Project site.

1. Review methods and procedures related to HVAC air-distribution system cleaning including, but not limited to, review of the cleaning strategies and procedures plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.

B. Perform "Project Evaluation and Recommendation" according to NADCA ACR 2006.

C. Prepare written report listing conditions detrimental to performance of the Work.

D. Proceed with work only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare a written plan that includes strategies and step-by-step procedures. At a minimum, include the following:

1. Supervisor contact information.
2. Work schedule including location, times, and impact on occupied areas.
3. Methods and materials planned for each HVAC component type.
4. Required support from other trades.
5. Equipment and material storage requirements.
6. Exhaust equipment setup locations.

B. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.

C. Comply with NADCA ACR 2006, "Guidelines for Constructing Service Openings in HVAC Systems" Section.

3.3 CLEANING

A. Comply with NADCA ACR 2006.

B. Remove visible surface contaminants and deposits from within the HVAC system.

C. Systems and Components to Be Cleaned:

1. Air devices for supply and return air.
2. Air-terminal units.
3. Ductwork:

a. Supply-air ducts, including turning vanes, to the air-handling unit.
b. Return-air ducts to the air-handling unit.
c. Exhaust-air ducts.

4. Air-Handling Units:

    a. Interior surfaces of the unit casing.
    b. Coil surfaces compartment.
    c. Condensate drain pans.
    d. Fans, fan blades, and fan housings.

5. Filters and filter housings.

D. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.

E. Particulate Collection:

1. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,

F. Control odors and mist vapors during the cleaning and restoration process.

G. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.

H. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.

I. Clean all air-distribution devices, registers, grilles, and diffusers.

J. Clean visible surface contamination deposits according to NADCA ACR 2006 and the following:

1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
3. Clean evaporator coils, reheat coils, and other airstream components.

K. Duct Systems:

1. Create service openings in the HVAC system as necessary to accommodate cleaning.
2. Mechanically clean duct systems specified to remove all visible contaminants so that the systems are capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).

L. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.

M. Mechanical Cleaning Methodology:

1. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.

    a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.
    b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.

2. Cleaning Mineral-Fiber Insulation Components:

    a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2006.
    b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2006).
    c. Fibrous materials that become wet shall be discarded and replaced.

N. Coil Cleaning:

1. Measure static-pressure differential across each coil.
2. See NADCA ACR 2006, "Coil Surface Cleaning" Section. Type 1, or Type 1 and Type 2, cleaning methods shall be used to render the coil visibly clean and capable of passing Coil Cleaning Verification (see applicable NADCA ACR 2006).
3. Coil drain pans shall be subject to NADCA ACR 2006, "Non-Porous Surfaces Cleaning Verification." Ensure that condensate drain pans are operational.
4. Electric-resistance coils shall be de-energized, locked out, and tagged before cleaning.
5. Cleaning methods shall not cause any appreciable damage to, cause displacement of, inhibit heat transfer, or cause erosion of the coil surface or fins, and shall comply with coil manufacturer's written recommendations when available.
6. Rinse thoroughly with clean water to remove any latent residues.

O. Antimicrobial Agents and Coatings:

1. Apply antimicrobial agents and coatings if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
2. When used, antimicrobial treatments and coatings shall be applied after the system is rendered clean.
3. Apply antimicrobial agents and coatings directly onto surfaces of interior ductwork.

4. Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.

3.4 CLEANLINESS VERIFICATION

A. Verify cleanliness according to NADCA ACR 2006, "Verification of HVAC System Cleanliness" Section.

B. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents and coatings.

C. Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.

D. Additional Verification:

1. Perform surface comparison testing or NADCA vacuum test.
2. Conduct NADCA vacuum gravimetric test analysis for nonporous surfaces.

E. Verification of Coil Cleaning:

1. Measure static-pressure differential across each coil.
2. Coil will be considered clean if cleaning restored the coil static-pressure differential within 10 percent of the differential measured when the coil was first installed.
3. Coil will be considered clean if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection.

F. Prepare a written cleanliness verification report. At a minimum, include the following:

1. Written documentation of the success of the cleaning.
2. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
3. Surface comparison test results if required.
4. Gravimetric analysis (nonporous surfaces only).
5. System areas found to be damaged.

G. Photographic Documentation: Comply with requirements in DDC General Conditions.

3.5 RESTORATION

A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2006, "Restoration and Repair of Mechanical Systems" Section.

B. Restore service openings capable of future reopening. Comply with requirements in Section 233113 "Metal Ducts." Include location of service openings in Project closeout report.

C. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing. Comply with requirements in Section 233113 "Metal Ducts"

D. Replace damaged insulation according to Section 230713 "Duct Insulation."

E. Ensure that closures do not hinder or alter airflow.

F. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

END OF SECTION 230130.51

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

This Page Intentionally Left Blank

SECTION 230516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Flexible, ball-joint, packed expansion joints.
2. Slip-joint packed expansion joints.
3. Expansion-compensator packless expansion joints.
4. Flexible-hose packless expansion joints.
5. Metal-bellows packless expansion joints.
6. Grooved-joint expansion joints.
7. Pipe loops and swing connections.
8. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Engineering Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Submittal data shall include certification that the piping system has been examined for excessive stresses and that none will exist in the proposed design. Submittals for vertical risers must include riser diagrams calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure and spring deflection changes.

1. Design Calculations: Calculate pipe stresses and other requirements for thermal expansion of piping systems in order to properly select and design horizontal expansion

joints, loops, and/or swing connections and vertical anchors with spring isolators. Submit analysis indicating movements and forces acting on the structural systems at all attachments to structure and horizontal attachments to risers.

2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Spring Isolator Details: Detail field assembly and attachment to building structure.
5. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

C. Responsibility: It is the contractor's responsibility to assess the final coordinated shop drawings for expansion risk and to then perform actions as required by this specification to mitigate conditions arising from final proposed installation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of expansion joint, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For expansion joints to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PACKED EXPANSION JOINTS

A. Flexible, Ball-Joint, Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advanced Thermal Systems, Inc.
   b. Hyspan Precision Products, Inc.

2. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; and ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.

3. Material: Carbon-steel assembly with asbestos-free composition packing.
4. Design: For 360-degree rotation and angular deflection.
5. Minimum Pressure Rating: 250 psig at 400 deg F.
6. Angular Deflection for NPS 6 and Smaller: 30 degree minimum.
7. Angular Deflection for NPS 8 and Larger: 15 degree minimum.
8. End Connections for NPS 2 and Smaller: Threaded.
9. End Connections for NPS 2-1/2 and Larger: Flanged.

B. Slip-Joint Packed Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Adsco Manufacturing LLC.
   b. Advanced Thermal Systems, Inc.
   c. Hyspan Precision Products, Inc.

2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
5. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
6. End Connections: Flanged or weld ends to match piping system.

2.2 PACKLESS EXPANSION JOINTS

A. Metal, Expansion-Compensator Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Adsco Manufacturing LLC.
   b. Flexicraft Industries.
   c. Flex Pression Ltd.
   d. Flex-Weld, Inc.
   e. Hyspan Precision Products, Inc.
   f. Metraflex, Inc.
   g. Senior Flexonics Pathway.
   h. Unaflex.
   i. Unisource Manufacturing, Inc.

2. Minimum Pressure Rating: 175 psig unless otherwise indicated.
3. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.

   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.

4. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.

    a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
    b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged.

B. Flexible-Hose Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flex-Hose Co., Inc.
    b. Flexicraft Industries.
    c. Flex Pression Ltd.
    d. Metraflex, Inc.
    e. Unisource Manufacturing, Inc.

2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.

    a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.

5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.

6. Expansion Joints for Steel PipingNPS 2 and Smaller: Carbon-steel fittings with threaded end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.

7. Expansion Joints for Steel PipingNPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

8. Expansion Joints for Steel PipingNPS 8 to NPS 12: Carbon-steel fittings with flanged end connections.

    a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
    b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

9. Expansion Joints for Steel PipingNPS 14 and Larger: Carbon-steel fittings with flanged end connections.

    a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

C. Metal-Bellows Packless Expansion Joints:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Adsco Manufacturing LLC.
    b. American BOA, Inc.
    c. Badger Industries, Inc.
    d. Expansion Joint Systems, Inc.
    e. Flex-Hose Co., Inc.
    f. Flexicraft Industries.
    g. Flex Pression Ltd.
    h. Flex-Weld, Inc.
    i. Flo Fab inc.
    j. Hyspan Precision Products, Inc.
    k. Metraflex, Inc.
    l. Proco Products, Inc.
    m. Senior Flexonics Pathway.
    n. Tozen Corporation.
    o. Unaflex.
    p. Unisource Manufacturing, Inc.
    q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
    r. U.S. Bellows, Inc.
    s. WahlcoMetroflex.

2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 175 psig unless otherwise indicated.
5. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

    a. End Connections for Copper Tubing NPS 2 and Smaller: threaded.
    b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: threaded.

c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.

7. Expansion Joints for Steel Piping: Single- or multi-ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.

a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

2.3 GROOVED-JOINT EXPANSION JOINTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Anvil International, Inc.
2. Shurjoint Piping Products.
3. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: 10, flexible type for steel-pipe dimensions. Include ferrous housing sections, EPDM gasket suitable for cold and hot water, and bolts and nuts.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Adsco Manufacturing LLC.
b. Advanced Thermal Systems, Inc.
c. Flex-Hose Co., Inc.
d. Flexicraft Industries.
e. Flex-Weld, Inc.
f. Hyspan Precision Products, Inc.
g. Metraflex, Inc.
h. Senior Flexonics Pathway.
i. Unisource Manufacturing, Inc.
j. U.S. Bellows, Inc.

2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Stud: Threaded, zinc-coated carbon steel.
b. Expansion Plug: Zinc-coated steel.
c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install packed-type expansion joints with packing suitable for fluid service.

C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

D. Install rubber packless expansion joints according to FSA-NMEJ-702.

E. Install grooved-joint expansion joints to grooved-end steel piping

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.

C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.

D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:

1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.

1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION 230516

SECTION 230517

SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Presealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 Insert pipe size: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: PVC-pipe sleeves or Sleeve-seal fittings.
b. Piping NPS 6 and Larger: PVC-pipe sleeves or Stack-sleeve fittings.

5. Interior Partitions:

a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 230517

This Page Intentionally Left Blank

SECTION 230519

METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Filled-system thermometers.
3. Liquid-in-glass thermometers.
4. Light-activated thermometers.
5. Thermowells.
6. Dial-type pressure gages.
7. Gage attachments.
8. Test plugs.
9. Test-plug kits.
10. Sight flow indicators.
11. Orifice flowmeters.
12. Pitot-tube flowmeters.
13. Turbine flowmeters.
14. Venturi flowmeters.
15. Vortex-shedding flowmeters.
16. Impeller-turbine, thermal-energy meters.
17. Ultrasonic, thermal-energy meters.

B. Related Sections:

1. Section 262713 "Electricity Metering".
2. Section 220519 "Meters and Gage for Plumbing Piping"

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Trerice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 FILLED-SYSTEM THERMOMETERS

A. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Miljoco Corporation.
    d. Palmer Wahl Instrumentation Group.
    e. REOTEMP Instrument Corporation.
    f. Trerice, H. O. Co.
    g. Weiss Instruments, Inc.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 5-inch nominal diameter.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, dampening type, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

B. Remote-Mounted, Metal-Case, Vapor-Actuated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMETEK, Inc.; U.S. Gauge.
    b. Ashcroft Inc.
    c. Marsh Bellofram.
    d. Miljoco Corporation.
    e. Palmer Wahl Instrumentation Group.
    f. REOTEMP Instrument Corporation.

g. Trerice, H. O. Co.
h. Weiss Instruments, Inc.
i. WIKA Instrument Corporation - USA.

2. Standard: ASME B40.200.
3. Case: Sealed type, cast aluminum or drawn steel; 6-inch nominal diameter with front flange and holes for panel mounting.
4. Element: Bourdon tube or other type of pressure element.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Stainless steel.
10. Connector Type(s): Union joint, bottom; with ASME B1.1 screw threads.
11. Thermal System: Liquid-filled bulb in copper-plated steel, aluminum, or brass stem and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

12. Accuracy: Plus or minus 1 percent of scale range.

2.3 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Trerice, H. O. Co.
    b. Weiss Instruments.
    c. Winters Instruments.
    d. Ashcroft
    e. Palmer – Wahl Instruments Inc.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

9. Connector: 3/4 inch, with ASME B1.1 screw threads.

10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flo Fab Inc.
   b. Miljoco Corporation.
   c. Palmer Wahl Instrumentation Group.
   d. Tel-Tru Manufacturing Company.
   e. Trerice, H. O. Co.
   f. Weiss Instruments, Inc.
   g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.

   a. Design for Air-Duct Installation: With ventilated shroud.
   b. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.4 LIGHT-ACTIVATED THERMOMETERS

A. Direct-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flo Fab Inc.
   b. REOTEMP Instrument Corporation.
   c. Trerice, H. O. Co.
   d. Weiss Instruments, Inc.
   e. WIKA Instrument Corporation - USA.
   f. Winters Instruments - U.S.

2. Case: Metal; 9-inch nominal size unless otherwise indicated.
3. Scale(s): Deg F.
4. Case Form: Adjustable angle.

5. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
6. Stem: Aluminum and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

7. Display: Digital.
8. Accuracy: Plus or minus 2 deg F.

B. Remote-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Miljoco Corporation.
    b. Weiss Instruments, Inc.
    c. Winters Instruments - U.S.

2. Case: Plastic, for wall mounting.
3. Scale(s): Deg F.
4. Sensor: Bulb and thermister wire.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

5. Display: Digital.
6. Accuracy: Plus or minus 2 deg F.

2.5 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.6 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.7 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.
   h. Palmer Wahl Instrumentation Group.
   i. REOTEMP Instrument Corporation.
   j. Tel-Tru Manufacturing Company.
   k. Trerice, H. O. Co.
   l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   m. Weiss Instruments, Inc.
   n. WIKA Instrument Corporation - USA.
   o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Solid-front, pressure relief type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal, Brass, or Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Ernst Flow Industries.
   d. Flo Fab Inc.
   e. Marsh Bellofram.
   f. Miljoco Corporation.
   g. Noshok.

h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; cast aluminum or drawn steel; 6-inch nominal diameter with front flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Metal or Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.8 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

2.9 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.10 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.11 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Archon Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Brooks Instrument.
4. Ernst Co., John C., Inc.
5. Ernst Flow Industries.
6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
7. OPW Engineered Systems; a Dover company.
8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 150 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

2.12 FLOWMETERS

A. Orifice Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB; Instrumentation and Analytical.
    b. Bell & Gossett; ITT Industries.
    c. Meriam Process Technologies.
    d. Preso Meters; a division of Racine Federated Inc.
    e. S. A. Armstrong Limited; Armstrong Pumps Inc.

2. Description: Flowmeter with sensor, hoses or tubing, fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.

    a. Design: Differential-pressure-type measurement for water.
    b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
    c. Minimum Pressure Rating: 300 psig.
    d. Minimum Temperature Rating: 250 deg F.

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected sensor and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to sensor.

    a. Scale: Gallons per minute.
    b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.

    a. Scale: Gallons per minute.

b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Conversion Chart: Flow rate data compatible with sensor and indicator.
9. Operating Instructions: Include complete instructions with each flowmeter.

B. Pitot-Tube Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABB; Instrumentation and Analytical.
   b. Emerson Process Management; Rosemount.
   c. Meriam Process Technologies.
   d. Preso Meters; a division of Racine Federated Inc.
   e. TACO Incorporated.
   f. Veris Industries, Inc.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.

   a. Design: Differential-pressure-type measurement for water.
   b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
   c. Minimum Pressure Rating: 150 psig.
   d. Minimum Temperature Rating: 250 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Integral Transformer: For low-voltage power connection.
7. Accuracy: Plus or minus 3 percent.
8. Display: Shows rate of flow, with register to indicate total volume in gallons.
9. Operating Instructions: Include complete instructions with each flowmeter.

C. Turbine Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ABB; Instrumentation and Analytical.
   b. Data Industrial Corp.
   c. EMCO Flow Systems; a division of Spirax Sarco, Inc.
   d. ERDCO Engineering Corp.
   e. Hoffer Flow Controls, Inc.
   f. Liquid Controls; a unit of IDEX Corporation.
   g. McCrometer, Inc.
   h. Midwest Instruments & Controls Corp.
   i. ONICON Incorporated.
   j. SeaMetrics, Inc.

k. Sponsler, Inc.; a unit of IDEX Corporation.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute.

    a. Design: Device or pipe fitting with inline turbine and integral direct-reading scale for water.
    b. Construction: Bronze or stainless-steel body, with plastic turbine or impeller.
    c. Minimum Pressure Rating: 150 psig.
    d. Minimum Temperature Rating: 180 deg F.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 1-1/2 percent.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Operating Instructions: Include complete instructions with each flowmeter.

D. Venturi Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB; Instrumentation and Analytical.
    b. Gerand Engineering Co.
    c. Hyspan Precision Products, Inc.
    d. Preso Meters; a division of Racine Federated Inc.
    e. S. A. Armstrong Limited; Armstrong Pumps Inc.
    f. Victaulic Company.

2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.

    a. Design: Differential-pressure-type measurement for water.
    b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
    c. Minimum Pressure Rating: 250 psig.
    d. Minimum Temperature Rating: 250 deg F.
    e. End Connections for NPS 2 and Smaller: Threaded.
    f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
    g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.

5. Permanent Indicators: Meter suitable for wall or bracket mounting, calibrated for connected flowmeter element, and having 6-inch- diameter, or equivalent, dial with fittings and copper tubing for connecting to flowmeter element.

a. Scale: Gallons per minute.
b. Accuracy: Plus or minus 1 percent between 20 and 80 percent of scale range.

6. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected flowmeter element and having two 12-foot hoses, with carrying case.

a. Scale: Gallons per minute.
b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range.

7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Conversion Chart: Flow rate data compatible with sensor.
9. Operating Instructions: Include complete instructions with each flowmeter.

E. Vortex-Shedding Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB; Instrumentation and Analytical.
b. Eastech Flow Controls.
c. EMCO Flow Systems; a division of Spirax Sarco, Inc.
d. Emerson Process Management; Rosemount.
e. Endress+Hauser.
f. ISTEC Corporation.

2. Description: Flowmeter with sensor and indicator.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Inline type; for installing between pipe flanges and measuring flow directly in gallons per minute.

a. Design: Flow obstruction device, vortex-measurement type for liquids.
b. Construction: Stainless-steel body, with integral transmitter and direct-reading scale.
c. Minimum Pressure Rating: 1000 psig.
d. Minimum Temperature Rating: 500 deg F.
e. Integral Transformer: For low-voltage power operation.

5. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
6. Accuracy: Plus or minus 0.25 percent for liquids.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Operating Instructions: Include complete instructions with each flowmeter.

2.13 THERMAL-ENERGY METERS

A. Impeller-Turbine, Thermal-Energy Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Data Industrial Corp.
b. Hoffer Flow Controls, Inc.
c. ISTEC Corporation.
d. ONICON Incorporated.

2. Description: System with strainer, flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
3. Flow Sensor: Impeller turbine with corrosion-resistant-metal body and transmitter; for installing in piping.

    a. Design: Total thermal-energy measurement.
    b. Minimum Pressure Rating: 150 psig.
    c. Minimum Temperature Range: 40 to 250 deg F.

4. Temperature Sensors: Insertion-type transducer.
5. Indicator: Solid-state, integrating-type meter with integral battery pack; for wall mounting.

    a. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
    b. Battery Pack: Five-year lithium battery.

6. Accuracy: Plus or minus 1 percent.
7. Display: Visually indicates total fluid volume in gallons and thermal-energy flow in kilowatts per hour or British thermal units.
8. Strainer: Full size of main line piping.
9. Operating Instructions: Include complete instructions with each thermal-energy meter system.

B. Ultrasonic, Thermal-Energy Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. EMCO Flow Systems; a division of Spirax Sarco, Inc.
    b. Siemens Energy & Automation, Inc.

2. Description: Meter with flow sensor, temperature sensors, transmitter, indicator, and connecting wiring.
3. Flow Sensor: Transit-time ultrasonic type with transmitter.
4. Temperature Sensors: Insertion-type or strap-on transducer.
5. Indicator: Solid-state, integrating-type meter with integral battery pack.

    a. Data Output: Six-digit electromechanical counter with readout in kilowatts per hour or British thermal units.
    b. Battery Pack: Five-year lithium battery.

6. Accuracy: Plus or minus 1 percent.
7. Display: Visually indicates total fluid volume in gallons and thermal-energy flow in kilowatts per hour or British thermal units.

8. Operating Instructions: Include complete instructions with each thermal-energy meter system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

I. Install remote-mounted pressure gages on panel.

J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

K. Install valve and syphon fitting in piping for each pressure gage for steam.

L. Install test plugs in piping tees.

M. Install flow indicators in piping systems in accessible positions for easy viewing.

N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

O. Install flowmeter elements in accessible positions in piping systems.

P. Install wafer-orifice flowmeter elements between pipe flanges.

Q. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

R. Install permanent indicators on walls or brackets in accessible and readable positions.

S. Install connection fittings in accessible locations for attachment to portable indicators.

T. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.

U. Install thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic boiler.
3. Two inlets and two outlets of each heat pump unit
4. Inlet and outlet of each hydronic coil.
5. Two inlets and two outlets of each hydronic heat exchanger.
6. Inlet and outlet of each thermal-storage tank.
7. Outside-, return-, supply-, and mixed-air ducts.
8. As shown on riser diagrams and controls riser diagrams.

V. Install pressure gages in the following locations:

1. Discharge of each pressure-reducing valve.
2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
3. Suction and discharge of each pump.
4. As shown on riser diagrams and controls riser diagrams.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each hydronic zone shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Thermometers at inlet and outlet of each hydronic boiler shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

C. Thermometers at inlets and outlets of each chiller shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

D. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

E. Thermometers at inlets and outlets of each hydronic heat exchanger shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

F. Thermometers at inlet and outlet of each hydronic heat-recovery unit shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Direct-mounted, metal-case, vapor-actuated type.
3. Industrial-style, liquid-in-glass type.
4. Direct-mounted, light-activated type.
5. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

G. Thermometers at outside-, return-, supply-, and mixed-air ducts shall be one of the following:

1. Sealed, bimetallic-actuated type.
2. Remote-mounted, metal-case, vapor-actuated type.
3. Compact-style, liquid-in-glass type.
4. Remote-mounted, light-activated type.

H. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Dual-temperature Water Piping: 0 to 250 deg F.

B. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

C. Scale Range for Air Ducts: Minus 40 to plus 110 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each pressure-reducing valve shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each chiller chilled-water and condenser-water connection shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each pump shall be one of the following:

1. Sealed, direct-mounted, metal case.
2. Sealed, direct-mounted, plastic case.
3. Test plug with chlorosulfonated polyethylene synthetic self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Dual-temperature Water Piping 0 to 200 psi.

B. Scale Range for Heating, Hot-Water Piping: 0 to 200 psi.

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Dual-temperature Water Piping: Orifice, Pitot-tube, Turbine, Venturi, or Vortex-shedding type.

B. Flowmeters for Hot-Water Piping: Orifice, Pitot-tube, Turbine, Venturi, or Vortex-shedding type.

3.9 THERMAL-ENERGY METER SCHEDULE

A. Thermal-Energy Meters for Dual-temperature Water Piping: Impeller-turbine or Ultrasonic type.

B. Thermal-Energy Meters for Heating, Hot-Water Piping: Impeller-turbine or Ultrasonic type.

END OF SECTION 230519

This Page Intentionally Left Blank

SECTION 230523

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Iron ball valves.
5. Iron, single-flange butterfly valves.
6. High-performance butterfly valves.
7. Bronze lift check valves.
8. Bronze swing check valves.
9. Iron swing check valves.
10. Iron swing check valves with closure control.
11. Iron, center-guided check valves.
12. Iron, plate-type check valves.
13. Bronze gate valves.
14. Iron gate valves.
15. Bronze globe valves.
16. Iron globe valves.
17. Lubricated plug valves.
18. Eccentric plug valves.
19. Chainwheels.

B. Related Sections:

1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure (not applicable to this project)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to HVAC valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 and smaller.
4. Wrench: For plug valves with square heads. Furnish City of New York with 1 wrench for every 5 plug valves, for each size square plug-valve head.
5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Hammond Valve.
b. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

C. Class 150, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.
b. Kitz Corporation.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

D. Class 150, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

2.3 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

a. Kitz Corporation.

b. Nibco.

c. Flow-tek.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig.
c. Body Design: One piece.
d. Body Material: Forged brass.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. DynaQuip Controls.
d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
e. Hammond Valve.
f. Jamesbury; a subsidiary of Metso Automation.
g. Jomar International, LTD.
h. Kitz Corporation.
i. Legend Valve.
j. Marwin Valve; a division of Richards Industries.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Red-White Valve Corporation.
n. RuB Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

C. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
d. Hammond Valve.
e. Jamesbury; a subsidiary of Metso Automation.
f. Kitz Corporation.
g. Marwin Valve; a division of Richards Industries.
h. Milwaukee Valve Company.
i. RuB Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.

f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

D. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Jamesbury; a subsidiary of Metso Automation.
c. Legend Valve.
d. Marwin Valve; a division of Richards Industries.
e. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Regular.

E. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Jamesbury; a subsidiary of Metso Automation.
b. Marwin Valve; a division of Richards Industries.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Brass or bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

F. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jomar International, LTD.
   b. Kitz Corporation.
   c. Red-White Valve Corporation.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Three piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Brass.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

G. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jomar International, LTD.
   b. Kitz Corporation.
   c. Marwin Valve; a division of Richards Industries.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig.
   c. CWP Rating: 600 psig.
   d. Body Design: Three piece.
   e. Body Material: Forged brass.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Full.

2.4 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. NIBCO INC.

2. Description:

    a. Standard: MSS SP-110.
    b. CWP Rating: 400 psig.
    c. Body Design: One piece.
    d. Body Material: Bronze.
    e. Ends: Threaded.
    f. Seats: PTFE or TFE.
    g. Stem: Bronze.
    h. Ball: Chrome-plated brass.
    i. Port: Reduced.

B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. NIBCO INC.

2. Description:

    a. Standard: MSS SP-110.
    b. CWP Rating: 600 psig.
    c. Body Design: One piece.
    d. Body Material: Bronze.
    e. Ends: Threaded.
    f. Seats: PTFE or TFE.
    g. Stem: Stainless steel.
    h. Ball: Stainless steel, vented.
    i. Port: Reduced.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Crane Co.; Crane Valve Group; Crane Valves.
    d. Hammond Valve.
    e. Lance Valves; a division of Advanced Thermal Systems, Inc.
    f. Legend Valve.

g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Lance Valves; a division of Advanced Thermal Systems, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

E. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.

b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. DynaQuip Controls.
f. Hammond Valve.
g. Lance Valves; a division of Advanced Thermal Systems, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

F. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

G. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. DynaQuip Controls.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

H. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.5 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Kitz Corporation.
d. Sure Flow Equipment Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig.
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

2.6 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.
i. Kitz Corporation.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Norriseal; a Dover Corporation company.
m. Red-White Valve Corporation.
n. Spence Strainers International; a division of CIRCOR International.
o. Tyco Valves & Controls; a unit of Tyco Flow Control.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.

e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

B. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.
i. Kitz Corporation.
j. Milwaukee Valve Company.
k. NIBCO INC.
l. Norriseal; a Dover Corporation company.
m. Red-White Valve Corporation.
n. Spence Strainers International; a division of CIRCOR International.
o. Tyco Valves & Controls; a unit of Tyco Flow Control.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

C. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.

i. Kitz Corporation.
j. Milwaukee Valve Company.
k. Mueller Steam Specialty; a division of SPX Corporation.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Spence Strainers International; a division of CIRCOR International.
o. Sure Flow Equipment Inc.
p. Tyco Valves & Controls; a unit of Tyco Flow Control.
q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

D. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.
i. Kitz Corporation.
j. Milwaukee Valve Company.
k. Mueller Steam Specialty; a division of SPX Corporation.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Spence Strainers International; a division of CIRCOR International.
o. Sure Flow Equipment Inc.
p. Tyco Valves & Controls; a unit of Tyco Flow Control.
q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.

d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

E. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.
i. Kitz Corporation.
j. Milwaukee Valve Company.
k. Mueller Steam Specialty; a division of SPX Corporation.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International.
p. Sure Flow Equipment Inc.
q. Tyco Valves & Controls; a unit of Tyco Flow Control.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

F. 150 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.

f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Hammond Valve.
i. Kitz Corporation.
j. Milwaukee Valve Company.
k. Mueller Steam Specialty; a division of SPX Corporation.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International.
p. Sure Flow Equipment Inc.
q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 150 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

G. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Flo Fab Inc.
h. Hammond Valve.
i. Kitz Corporation.
j. Legend Valve.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.

c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

H. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Flo Fab Inc.
h. Hammond Valve.
i. Kitz Corporation.
j. Legend Valve.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

I. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Center Line.

f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Spence Strainers International; a division of CIRCOR International.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated ductile iron.

J. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Spence Strainers International; a division of CIRCOR International.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated or -coated ductile iron.

K. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Red-White Valve Corporation.
q. Spence Strainers International; a division of CIRCOR International.
r. Sure Flow Equipment Inc.
s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

L. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Red-White Valve Corporation.
q. Spence Strainers International; a division of CIRCOR International.
r. Sure Flow Equipment Inc.
s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.7 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
d. Crane Co.; Crane Valve Group; Flowseal.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Hammond Valve.
h. Jamesbury; a subsidiary of Metso Automation.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Process Development & Control, Inc.

l. Tyco Valves & Controls; a unit of Tyco Flow Control.
m. Xomox Corporation.

2. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 285 psig at 100 deg F.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

B. Class 300, Single-Flange, High-Performance Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Bray Controls; a division of Bray International.
c. Cooper Cameron Valves; a division of Cooper Cameron Corp.
d. Crane Co.; Crane Valve Group; Flowseal.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Hammond Valve.
h. Jamesbury; a subsidiary of Metso Automation.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Process Development & Control, Inc.
l. Tyco Valves & Controls; a unit of Tyco Flow Control.
m. Xomox Corporation.

2. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 720 psig at 100 deg F.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, or ductile iron.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

2.8 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig.
    c. Body Design: Vertical flow.
    d. Body Material: ASTM B 61 or ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flo Fab Inc.
    b. Hammond Valve.
    c. Kitz Corporation.
    d. Milwaukee Valve Company.
    e. Mueller Steam Specialty; a division of SPX Corporation.
    f. NIBCO INC.
    g. Red-White Valve Corporation.
    h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 200 psig.
    c. Body Design: Vertical flow.
    d. Body Material: ASTM B 61 or ASTM B 62, bronze.
    e. Ends: Threaded.
    f. Disc: NBR, PTFE, or TFE.

2.9 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.

c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.

b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.10 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.

d. Hammond Valve.
e. Kitz Corporation.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Sure Flow Equipment Inc.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Composition.
h. Seat Ring: Bronze.
i. Disc Holder: Bronze.
j. Disc: PTFE or TFE.
k. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.

2.11 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

a. NIBCO INC.

b. Flow-tek.

c. Kitz

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.
e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and weight.

2.12 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.
e. Flo Fab Inc.
f. GA Industries, Inc.
g. Hammond Valve.
h. Metraflex, Inc.
i. Milwaukee Valve Company.
j. Mueller Steam Specialty; a division of SPX Corporation.
k. NIBCO INC.
l. Spence Strainers International; a division of CIRCOR International.
m. Sure Flow Equipment Inc.
n. Val-Matic Valve & Manufacturing Corp.
o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron.

e. Style: Compact wafer.
f. Seat: Bronze.

B. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flomatic Corporation.
e. Hammond Valve.
f. Metraflex, Inc.
g. Milwaukee Valve Company.
h. Mueller Steam Specialty; a division of SPX Corporation.
i. NIBCO INC.
j. Spence Strainers International; a division of CIRCOR International.
k. Sure Flow Equipment Inc.
l. Val-Matic Valve & Manufacturing Corp.
m. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: Bronze.

C. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
c. NPS 14 to NPS 24, CWP Rating: 250 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Compact wafer.
f. Seat: Bronze.

D. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crispin Valve.
   c. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
   c. NPS 14 to NPS 24, CWP Rating: 250 psig.
   d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
   e. Style: Globe, spring loaded.
   f. Ends: Flanged.
   g. Seat: Bronze.

E. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crispin Valve.
   c. DFT Inc.
   d. Flo Fab Inc.
   e. Hammond Valve.
   f. Metraflex, Inc.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Sure Flow Equipment Inc.
   j. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
   c. NPS 14 to NPS 24, CWP Rating: 300 psig.
   d. Body Material: ASTM A 126, gray iron.
   e. Style: Compact wafer, spring loaded.
   f. Seat: Bronze.

F. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.

b. Crispin Valve.
c. DFT Inc.
d. Flomatic Corporation.
e. Hammond Valve.
f. Metraflex, Inc.
g. Milwaukee Valve Company.
h. Mueller Steam Specialty; a division of SPX Corporation.
i. NIBCO INC.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: Bronze.

G. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 400 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Compact wafer, spring loaded.
f. Seat: Bronze.

H. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.

b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 400 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: Bronze.

I. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Spence Strainers International; a division of CIRCOR International.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Compact wafer.
f. Seat: EPDM or NBR.

J. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.
e. GA Industries, Inc.
f. Hammond Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: EPDM or NBR.

K. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
c. NPS 14 to NPS 24, CWP Rating: 250 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Compact wafer.
f. Seat: EPDM or NBR.

L. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
c. NPS 14 to NPS 24, CWP Rating: 250 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: EPDM or NBR.

M. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Sure Flow Equipment Inc.
i. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Compact wafer, spring loaded.
f. Seat: EPDM or NBR.

N. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 126, gray iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: EPDM or NBR.

O. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 400 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Compact wafer, spring loaded.
f. Seat: EPDM or NBR.

P. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 400 psig.
d. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
e. Style: Globe, spring loaded.
f. Ends: Flanged.
g. Seat: EPDM or NBR.

2.13 IRON, PLATE-TYPE CHECK VALVES

A. Class 125, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Flomatic Corporation.
d. Mueller Steam Specialty; a division of SPX Corporation.

2. Description:

a. Standard: API 594.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Wafer, spring-loaded plates.
e. Body Material: ASTM A 126, gray iron.
f. Seat: Bronze.

B. Class 150, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Mueller Steam Specialty; a division of SPX Corporation.
   d. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: API 594.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
   c. NPS 14 to NPS 24, CWP Rating: 250 psig.
   d. Body Design: Wafer, spring-loaded plates.
   e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
   f. Seat: Bronze.

C. Class 250, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crane Co.; Crane Valve Group; Crane Valves.

2. Description:

   a. Standard: API 594.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
   c. NPS 14 to NPS 24, CWP Rating: 300 psig.
   d. Body Design: Wafer, spring-loaded plates.
   e. Body Material: ASTM A 126, gray iron.
   f. Seat: Bronze.

D. Class 300, Iron, Dual-Plate Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Mueller Steam Specialty; a division of SPX Corporation.
   d. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: API 594.

b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 400 psig.
d. Body Design: Wafer, spring-loaded plates.
e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
f. Seat: Bronze.

E. Class 125, Iron, Single-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Flo Fab Inc.
b. Sure Flow Equipment Inc.

2. Description:

a. Standard: API 594.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Wafer, spring-loaded plate.
e. Body Material: ASTM A 126, gray iron.
f. Seat: EPDM or NBR.

F. Class 125, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. APCO Willamette Valve and Primer Corporation.
b. Cooper Cameron Valves TVB Techno.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. NIBCO INC.
f. Spence Strainers International; a division of CIRCOR International.
g. Sure Flow Equipment Inc.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: API 594.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Wafer, spring-loaded plates.
e. Body Material: ASTM A 126, gray iron.
f. Seat: EPDM or NBR.

G. Class 150, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Val-Matic Valve & Manufacturing Corp.

2. Description:

    a. Standard: API 594.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 300 psig.
    c. NPS 14 to NPS 24, CWP Rating: 250 psig.
    d. Body Design: Wafer, spring-loaded plates.
    e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
    f. Seat: EPDM or NBR.

H. Class 250, Iron, Wafer, Single-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

    a. Sure Flow Equipment Inc.

    b. Nibco.

    c. Kitz.

2. Description:

    a. Standard: API 594.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
    c. NPS 14 to NPS 24, CWP Rating: 300 psig.
    d. Body Design: Wafer, spring-loaded plate.
    e. Body Material: ASTM A 126, gray iron.
    f. Seat: EPDM or NBR.

I. Class 250, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Sure Flow Equipment Inc.

2. Description:

    a. Standard: API 594.

b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Design: Wafer, spring-loaded plates.
e. Body Material: ASTM A 126, gray iron.
f. Seat: EPDM or NBR.

J. Class 300, Iron, Dual-Plate Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: API 594.
b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
c. NPS 14 to NPS 24, CWP Rating: 400 psig.
d. Body Design: Wafer, spring-loaded plates.
e. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
f. Seat: EPDM or NBR.

2.14 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

C. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Kitz Corporation.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Powell Valves.
f. Red-White Valve Corporation.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

D. Class 150, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.15 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.

i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Disc: Solid wedge.
h. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. NIBCO INC.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
    c. NPS 14 to NPS 24, CWP Rating: 300 psig.
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Disc: Solid wedge.
    h. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Powell Valves.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. NPS 2-1/2 to NPS 12, CWP Rating: 500 psig.
    c. NPS 14 to NPS 24, CWP Rating: 300 psig.
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Disc: Solid wedge.
    h. Packing and Gasket: Asbestos free.

2.16 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
j. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

C. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Kitz Corporation.

d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.17 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Powell Valves.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-85, Type I.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-85, Type I.
   b. CWP Rating: 500 psig.
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.
   f. Packing and Gasket: Asbestos free.

2.18 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

   a. Nordstrom Valves, Inc.

   b. Nibco.

   c. Kitz.

2. Description:

   a. Standard: MSS SP-78, Type II.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
   c. NPS 14 to NPS 24, CWP Rating: 150 psig.
   d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
   e. Pattern: Venturi.
   f. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Nordstrom Valves, Inc.

2. Description:

a. Standard: MSS SP-78, Type II.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Venturi.
f. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Venturi.
f. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Venturi.
f. Plug: Cast iron or bronze with sealant groove.

E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

   a. Nordstrom Valves, Inc.

   b. Nibco

   c. Kitz

2. Description:

   a. Standard: MSS SP-78, Type II.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
   c. NPS 14 to NPS 24, CWP Rating: 300 psig.
   d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
   e. Pattern: Venturi.
   f. Plug: Cast iron or bronze with sealant groove.

F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

   a. Nordstrom Valves, Inc.

   b. Nibco.

   c. Kitz.

2. Description:

   a. Standard: MSS SP-78, Type II.
   b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
   c. NPS 14 to NPS 24, CWP Rating: 300 psig.
   d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
   e. Pattern: Venturi.
   f. Plug: Cast iron or bronze with sealant groove.

G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Homestead Valve; a division of Olson Technologies, Inc.

b. Milliken Valve Company.
c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

a. Standard: MSS SP-78, Type IV.
b. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
c. NPS 14 to NPS 24, CWP Rating: 300 psig.
d. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
e. Pattern: Regular or short.
f. Plug: Cast iron or bronze with sealant groove.

H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Homestead Valve; a division of Olson Technologies, Inc.
b. Milliken Valve Company.
c. R & M Energy Systems, a unit of Robbins & Myers, Inc.

d. Standard: MSS SP-78, Type IV.
e. NPS 2-1/2 to NPS 12, CWP Rating: 400 psig.
f. NPS 14 to NPS 24, CWP Rating: 300 psig.
g. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
h. Pattern: Venturi.
i. Plug: Cast iron or bronze with sealant groove.

2.19 ECCENTRIC PLUG VALVES

A. 175 CWP, Eccentric Plug Valves with Resilient Seating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Clow Valve Co.; a division of McWane, Inc.
b. DeZurik Water Controls.
c. Homestead Valve; a division of Olson Technologies, Inc.
d. M&H Valve Company; a division of McWane, Inc.
e. Milliken Valve Company.
f. Henry Pratt Company.
g. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-108.
b. CWP Rating: 175 psig minimum.

c. Body and Plug: ASTM A 48/A 48M, gray iron; ASTM A 126, gray iron; or ASTM A 536, ductile iron.
d. Bearings: Oil-impregnated bronze or stainless steel.
e. Ends: Flanged.
f. Stem-Seal Packing: Asbestos free.
g. Plug, Resilient-Seating Material: Suitable for potable-water service unless otherwise indicated.

2.20 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to ball butterfly and plug valve stems.
3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service except Steam: Globe, ball, or butterfly valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping except Steam and Steam Condensate Piping: Valve ends may be grooved.

3.5 SOURCE WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 150, bronze disc.
3. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
5. Bronze Gate Valves: Class 150, NRS.
6. Bronze Globe Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, stainless-steel disc.
4. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, EPDM seat, stainless-steel disc.
5. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 300 CWP.
6. High-Performance Butterfly Valves: Class 300, single flange.
7. Iron Swing Check Valves: Class 250, metal seats.
8. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
9. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
10. Iron, Center-Guided Check Valves, NPS 2-1/2 to NPS 24: Class 300, metal seat.
11. Iron, Plate-Type Check Valves: Class 250; dual plate; metal seat.
12. Iron Gate Valves: Class 250, NRS.
13. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 250.
14. Lubricated Plug Valves: Class 250, regular gland, flanged.

3.6 DUAL TEMPERATURE WATER AND FREE COOLING RADIANT WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

2. Bronze Angle Valves: Class 150, nonmetallic disc.
3. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 150, nonmetallic disc.
5. Bronze Gate Valves: Class 150, NRS.
6. Bronze Globe Valves: Class 150, nonmetallic disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, stainless-steel disc.
4. Iron, Single-Flange Butterfly Valves, NPS 14 to NPS 24: 150 CWP, EPDM seat, stainless-steel disc.
5. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 300 CWP.
6. High-Performance Butterfly Valves: Class 300, single flange.
7. Iron Swing Check Valves: Class 250, nonmetallic-to-metal seats.
8. Iron Swing Check Valves with Closure Control, NPS 2-1/2 to NPS 12: Class 125, lever and spring.
9. Iron, Grooved-End Check Valves, NPS 3 to NPS 12: 300 CWP.
10. Iron, Center-Guided Check Valves: Class 250, globe, metal seat.
11. Iron, Plate-Type Check Valves: Class 250; dual plate; metal seat.
12. Iron Gate Valves: Class 250, NRS.
13. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 250.

END OF SECTION 230523

This Page Intentionally Left Blank

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
3. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
4. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Engineering Criteria Submittal: Provide trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Provide supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water. Provide documentation to demonstrate compliance where requested.
2. Provide equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components. Provide documentation to demonstrate compliance where requested.
3. Provide seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction. Provide documentation to demonstrate compliance where requested.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Pipe stands.
4. Equipment supports.

C. Engineering Submittal: For trapeze hangers indicated to comply with performance requirements and engineering criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Engineering Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Hot-dipped galvanized.
8. Paint Coating: Epoxy.
9. Plastic Coating: PVC.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International; a subsidiary of Mueller Water Products Inc.
   b. Empire Industries, Inc.
   c. ERICO International Corporation.
   d. Haydon Corporation; H-Strut Division.
   e. NIBCO INC.
   f. PHD Manufacturing, Inc.
   g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating: Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated stainless steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

N. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099000.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230533

HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes heat tracing for HVAC piping with the following electric heating cables:
   1. Self-regulating, parallel resistance.

B. Related Requirements:
   1. Section 220533 "Heat Tracing for Plumbing Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
   2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.

   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BriskHeat.
2. Chromalox.
3. Delta-Therm Corporation.
4. Easy Heat; a division of EGS Electrical Group LLC.
5. Nelson Heat Trace; a division of EGS Electrical Group LLC.
6. Pyrotenax; a brand of Tyco Thermal Controls LLC.
7. Raychem; a brand of Tyco Thermal Controls LLC.

B. Comply with IEEE 515.1.

C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

D. Electrical Insulating Jacket: Flame-retardant polyolefin.

E. Maximum Operating Temperature (Power On): 150 deg F.

F. Maximum Exposure Temperature (Power Off): 185 deg F.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Capacities and Characteristics:

1. Maximum Heat Output: 8 W/ft.
2. Piping Diameter: refer to drawings.
3. Spiral Wrap Pitch: As per manufacturer's instructions.
4. Electrical Characteristics for Single-Circuit Connection:

a. Volts: 277.
b. Phase: 1.

c. Hertz: 60.

2.2 CONTROLS

A. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.

B. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

C. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

D. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install electric heating cable across expansion joints according to manufacturer's written instructions; use slack cable to allow movement without damage to cable.

B. Install electric heating cables after piping has been tested and before insulation is installed.

C. Install electric heating cables according to IEEE 515.1.

D. Install insulation over piping with electric cables according to Section 230719 "HVAC Piping Insulation."

E. Install warning tape on piping insulation where piping is equipped with electric heating cables.

F. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
2. Test cables for electrical continuity and insulation integrity before energizing.
3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

E. Cables will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 230533

SECTION 230548

VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Air-spring isolators.
11. Restrained-air-spring isolators.
12. Elastomeric hangers.
13. Spring hangers.
14. Snubbers.
15. Restraint channel bracings.
16. Restraint cables.
17. Mechanical anchor bolts.
18. Adhesive anchor bolts.
19. Vibration isolation equipment bases.
20. Restrained isolation roof-curb rails.

B. Related Requirements:

1. Section 210548 "Vibration and Seismic Controls for Fire Suppression" for devices for fire-suppression equipment and systems.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device required.
   a. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Engineering Submittal: For each vibration isolation device.

1. Include engineering calculations and details for selecting vibration isolators and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Engineering Calculations: Document static and dynamic loading due to equipment weight, operation, and wind forces required to select vibration isolators and wind restraints and for designing vibration isolation bases.

   a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system was examined for excessive stress and that none exists.
4. Wind-Restraint Details:

   a. Design Analysis: To support selection and arrangement of wind restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and

values of forces transmitted to the structure. Indicate association with vibration isolation devices.

c. Coordinate vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

B. Qualification Data: For professional engineer and testing agency.

C. Welding certificates.

D. Air-Mounting System Performance Certification: Include natural frequency, load, and damping test data performed by an independent agency.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-spring mounts and restrained-air-spring mounts to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 90 MPH.
2. Building Classification Category: II.

3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction, and 45 degrees either side of normal.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient and elastomeric.

    a. Surface Pattern: Waffle pattern.
    b. Infused nonwoven cotton or synthetic fibers.

2.3 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.6 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with attachment and leveling bolt.

2.7 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ace Mountings Co., Inc.

b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top plate with threaded mounting holes or elastomeric pad.
c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psigon isolation material providing equal isolation in all directions.

2.10 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.11 AIR-SPRING ISOLATORS

A. Freestanding, Single or Multiple, Compressed-Air Bellows:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Firestone Industrial Products Company.
   b. Mason Industries, Inc.

2. Bellows Assembly: Upper and lower powder-coated steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows or similar elastomeric material.
3. Maximum Natural Frequency: 3 Hz.
4. Operating Pressure Range: 25 to 100 psig.
5. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
6. Tank valves.

2.12 RESTRAINED-AIR-SPRING ISOLATORS

A. Freestanding, Single or Multiple, Compressed-Air Bellows with Vertical-Limit Stop Restraint:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Firestone Industrial Products Company.
    b. Mason Industries, Inc.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top plate with threaded mounting holes or elastomeric pad.
    c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
8. Bellows Assembly: Upper and lower powder-coated steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows or similar elastomeric material.
9. Maximum Natural Frequency: 3 Hz.
10. Operating Pressure Range: 25 to 100 psig.
11. Burst Pressure: At least three times manufacturer's published maximum operating pressure.
12. Tank valves.

2.13 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.14 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Kinetics Noise Control, Inc.
    d. Mason Industries, Inc.
    e. Vibration Eliminator Co., Inc.
    f. Vibration Isolation.
    g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.15 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Mountings & Controls, Inc.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

2.16 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.17 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 603 galvanized, ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.18 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Cooper B-Line, Inc.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.19 ADHESIVE ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.20 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. California Dynamics Corporation.
2. Kinetics Noise Control.
3. Mason Industries, Inc.
4. Vibration Eliminator Co., Inc.
5. Vibration Isolation.
6. Vibration Mountings & Controls, Inc.

B. Steel Rails: Factory-fabricated, welded, structural-steel rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

    a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Concrete Inertia Base: Factory-fabricated or field-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

   a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.21 RESTRAINED ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Ace Mountings Co., Inc.
2. California Dynamics Corporation.
3. Kinetics Noise Control.
4. Mason Industries, Inc.
5. Thybar Corporation.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind forces.

C. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind forces.

D. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static loads within specified loading limits.

D. Rotating equipment (pumps, fans, ERVs) isolate as per this specification and as per manufacturer's recommendations.

3.3 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in all relevant concrete specifications.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:
   1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

E. Piping Restraints:

   1. Comply with requirements in MSS SP-127.
   2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

3. Brace a change of direction longer than 12 feet.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

J. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: City of New York will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with City of New York, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. Test and adjust restrained-air-spring isolator controls and safeties.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

3.6 AIR-SPRING ISOLATOR INSTALLATION

A. Independent Isolator Installation:

1. Install tank valve into each air isolator.
2. Inflate each isolator to height and pressure specified on Drawings.

B. Pressure-Regulated Isolator Installation:

1. Coordinate the constant pressure-regulated air supply to air springs with the requirements for piping and connections specified in Section 221513 "General-Service Compressed-Air Piping."
2. Connect all pressure regulators to a single dry, filtered facility air supply.
3. Inflate isolators to height and pressure specified on Drawings.

3.7 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Structural Specifications.

END OF SECTION 230548

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 incheshigh.

2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch Insert dimension thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Green.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Aluminum.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass beaded chain and S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire or string.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified architectural specification sections.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels , complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Dual Temperature Water "DTW" Piping:

a. Background Color: Dark Blue.
b. Letter Color: White.
c. Name: DTWS for dual temperature water supply
d. Name: DTWR for dual temperature water return

2. Source-Water "SW" Piping:

   a. Background Color: Green.
   b. Letter Color: White.
   c. Name: CWS for condenser water supply
   d. Name: CWR for condenser water return

3. Free Cooling Radiant "FCR" Water Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.
   c. Name: FCRS for free cooling radiant water supply
   d. Name: FCRR for free cooling radiant water return

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

   1. Blue: For air supply ducts.

   2. Green: For outdoor air ducts
   3. Yellow: For return air ducts.
   4. Green: For exhaust air ducts.
   5. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

   1. Valve-Tag Size and Shape:

      a. Dual Temperature Water: 2 inches, square.

b. Source Water: 2 inches, square.
c. Free Cooling Radiant Water: 2 inches, square.

2. Valve-Tag Color:

a. Dual Temperature Water: White.
b. Source Water: White.
c. Free Cooling Radiant Water: White.

3. Letter Color:

a. Dual Temperature Water: Black.

b. Source Water: Black
c. Free Cooling Radiant Water: Black.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

This Page Intentionally Left Blank

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.
b. Variable-flow hydronic systems.
c. Primary-secondary hydronic systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 ACTION SUBMITTALS

A. LEED Submittals:

1. Air-Balance Report for Prerequisite IEQ 1: Documentation of work performed for ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

2. TAB Report for Prerequisite EA 2: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by NEBB or TABB as a TAB technician.

B. TAB Conference: Meet with Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 PROJECT CONDITIONS

A. Full Owner Occupancy: City of New York will occupy the site and existing building during entire TAB period. Cooperate with City of New York during TAB operations to minimize conflicts with City of New York's operations.

B. Partial Owner Occupancy: City of New York may occupy completed areas of building before Substantial Completion. Cooperate with City of New York during TAB operations to minimize conflicts with City of New York's operations.

1.8 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, available TAB contractors that may be engaged include, but are not limited to, the following:

1. TAB contractor to be recommended by contractor and commissioning agent.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from City of New York, Construction Manager, and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record final fan-performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance variable-air-volume systems the same as described for constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

    a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

    a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from City of New York, Construction Manager, Commissioning Authority and comply with requirements in Section 232123 "Hydronic Pumps."

2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.

    a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 10 percent of design.

B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.

C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.

D. Set calibrated balancing valves, if installed, at calculated presettings.

E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.

J. Check settings and operation of each safety valve. Record settings.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.11 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

A. Balance the primary circuit flow first and then balance the secondary circuits.

3.12 PROCEDURES FOR HEAT EXCHANGERS

A. Measure water flow through all circuits.

B. Adjust water flow to within specified tolerances.

C. Measure inlet and outlet water temperatures.

D. Measure inlet steam pressure.

E. Check settings and operation of safety and relief valves. Record settings.

3.13 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.14 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.

5. Refrigerant suction pressure and temperature.

3.15 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.16 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.17 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.

3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.

f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.

b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.

n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Air flow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm.
b. Air velocity in fpm.
c. Preliminary air flow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final air flow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
   e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

   a. Air flow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.
   d. Water pressure drop in feet of head or psig.
   e. Entering-air temperature in deg F.
   f. Leaving-air temperature in deg F.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

   a. Unit identification.
   b. Location.
   c. Service.
   d. Make and size.
   e. Model number and serial number.
   f. Water flow rate in gpm.
   g. Water pressure differential in feet of head or psig.
   h. Required net positive suction head in feet of head or psig.
   i. Pump rpm.
   j. Impeller diameter in inches.
   k. Motor make and frame size.
   l. Motor horsepower and rpm.
   m. Voltage at each connection.
   n. Amperage for each phase.
   o. Full-load amperage and service factor.
   p. Seal type.

2. Test Data (Indicated and Actual Values):

   a. Static head in feet of head or psig.
   b. Pump shutoff pressure in feet of head or psig.
   c. Actual impeller size in inches.
   d. Full-open flow rate in gpm.
   e. Full-open pressure in feet of head or psig.
   f. Final discharge pressure in feet of head or psig.
   g. Final suction pressure in feet of head or psig.

h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

N. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.18 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 10 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Construction Manager and Commissioning Authority.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Construction Manager and Commissioning Authority.
3. Construction Manager and Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, City of New York may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.19 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

This Page Intentionally Left Blank

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 230716 "HVAC Equipment Insulation."
2. Section 230719 "HVAC Piping Insulation."
3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.

3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sheet Form Insulation Materials: 12 inches square.
2. Sheet Jacket Materials: 12 inches square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Provide a completed VOC submittal form per Section 01 81 13.

C. Product data Credit IEQ 4.1 / 4.2: For each adhesive, sealant, paint or coating product applied within the vapor barrier, documentation including printed statement of VOC content.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

E. Field quality-control reports.

F. LEED Submittal Requirements

1. For all installed products and materials of this Section which are within the LEED boundary, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the

Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

G. Product Pre-Review Documentation: Provide the following in compliance with Section 01 81 13 "Sustainable Design Requirements":
   1. List of the materials or products that will be submitted under this Specification Section. All alternatives being considered shall be noted.
   2. Product data detailing the material components of each assembly, if applicable.
   3. Completed Materials Inquiry Forms for each material or product.
   4. MSDS or other manufacturer data stating the chemical components of each product, including the Chemical Abstracts Service (CAS) numbers.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

   1. Ductwork Mockups:

      a. One 10-foot section each of rectangular and round straight duct.
      b. One each of a 90-degree mitered round and rectangular elbow, and one each of a 90-degree radius round and rectangular elbow.
      c. One rectangular branch takeoff and one round branch takeoff from a rectangular duct. One round tee fitting.
      d. One rectangular and round transition fitting.
      e. Four support hangers for round and rectangular ductwork.

f. Each type of damper and specialty.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Low emitting materials: Adhesive, sealant, paint and coating products used within the vapor barrier shall comply with VOC limits in Section 01 81 19.

B. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; CrimpWrap.
b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Manson Insulation Inc.; AK Flex.
e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

a. Johns Manville; Super Firetemp M.

b. Unifrax Corporation

c. 3M

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; FlameChek.
b. Johns Manville; Firetemp Wrap.
c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
d. Thermal Ceramics; FireMaster Duct Wrap.
e. 3M; Fire Barrier Wrap Products.
f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with jackets and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

B. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    b. Eagle Bridges - Marathon Industries; 501.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    b. Eagle Bridges - Marathon Industries; 570.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.
    e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    b. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.Eagle Bridges - Marathon Industries; 405.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    c. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

   a. Sheet and roll stock ready for shop or field sizing.
   b. Material, finish, and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
   d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Polyguard Products, Inc.; Alumaguard 60.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CWP-1.
      2) GEMCO; CD.
      3) Midwest Fasteners, Inc.; CD.
      4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) AGM Industries, Inc.; CHP-1.
      2) GEMCO; Cupped Head Weld Pin.
      3) Midwest Fasteners, Inc.; Cupped Head.
      4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide one of the following:

1) GEMCO; Nylon Hangers.
2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) GEMCO.
2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.12 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping"irestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.
   1. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.
      f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

   2. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

   3. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
   4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with insulation pins.
   1. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

2. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

3. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
4. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099000.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.11 DUCTWORK AND PLEUNUM INSULATION AND JACKET SCHEDULE

Ductwork System	Application	Jacket Type	Insulation Thickness & min. nom. density
Outdoor Air Supply (From OAHU's)	Exposed inside Roof MER's	Outdoor	2" (R = 6), 3.0lb/cu.ft
Outdoor Air Supply (From OAHU's)	Concealed inside building	Outdoor	2" (R = 6), 3.0lb/cu.ft
Supply Air	In Shaft	Indoor	1" (R = 3.5), 1.5lb/cu.ft
Return Air	In Shaft	Indoor	1" (R = 3.5), 1.5lb/cu.ft
Relief/Return Air	Inside of Space	Indoor	1" (R = 3.5), 1.5lb/cu.ft
Relief/Return Air	Exposed inside Roof MER's	Outdoor	2" (R = 6), 3.0lb/cu.ft
Outdoor Air Intake Plenums & Ductwork	Exposed inside Roof MER's	Outdoor	2" (R = 6), 3.0lb/cu.ft

Exhaust Ductwork	After Enthalpy wheel to exhaust plenum	Outdoor	1" (R = 3.5), 1.5lb/cu.ft
Exhaust Plenum	Exposed inside Roof MER's	Outdoor	2" (R = 6), 3.0lb/cu.ft
Garage Ductwork	Garage	Outdoor	1" (R = 3.5), 1.5lb/cu.ft

END OF SECTION 230713

SECTION 230716

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes insulating the following HVAC equipment that is not factory insulated:
   1. Heat exchangers.
   2. Dual-temperature heating and cooling water pumps.
   3. Radiant floor water pumps.
   4. Expansion/compression tanks.
   5. Air separators.
   6. Thermal storage tanks.
   7. Deaerators.
   8. Piping system filtration unit housings.

B. Related Sections:

   1. Section 230713 "Duct Insulation."
   2. Section 230719 "HVAC Piping Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. LEED Submittals: -

   1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail removable insulation at equipment connections.
   4. Detail application of field-applied jackets.
   5. Detail application at linkages of control devices.

6. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Sheet Jacket Materials: 12 inches square.
4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

E. Product Pre-Review Documentation: Provide the following in compliance with Section 01 81 13 "Sustainable Design Requirements":
1. List of the materials or products that will be submitted under this Specification Section. All alternatives being considered shall be noted.
2. Product data detailing the material components of each assembly, if applicable.
3. Completed Materials Inquiry Forms for each material or product.
4. MSDS or other manufacturer data stating the chemical components of each product, including the Chemical Abstracts Service (CAS) numbers.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Provide a completed VOC submittal form per Section 01 81 13.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Equipment Mockups:

   a. One dual temperature water pump

   b. One dedicated boiler pump.
   c. One tank or vessel.
   d. One Heat Exchanger

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Low emitting materials: Adhesive, sealant, paint and coating products used within the vapor barrier shall comply with VOC limits in Section 01 81 19.

B. Comply with requirements in "Breeching Insulation Schedule" and "Equipment Insulation Schedule" articles for where insulating materials shall be applied.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Calcium Silicate:

1. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

H. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Board Insulation: ASTM C 552, Type IV.
4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.

d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

J. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Industrial Insulation Group (IIG); MinWool-1200 Flexible Batt.
b. Johns Manville; HTB 26 Spin-Glas.
c. Roxul Inc.; Roxul RW.

K. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. Provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. CertainTeed Corp.; CertaPro Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

L. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Fibrex Insulations Inc.; FBX.Industrial Insulation Group (IIG); MinWool-1200 Industrial Board.
b. Rock Wool; Delta Board.
c. Roxul Inc.; RHT and RockBoard.
d. Thermafiber, Inc.; Thermafiber Industrial Felt.

M. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

N. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. CertainTeed Corp.; CrimpWrap.
   b. Johns Manville; MicroFlex.
   c. Knauf Insulation; Pipe and Tank Insulation.
   d. Manson Insulation Inc.; AK Flex.
   e. Owens Corning; Fiberglas Pipe and Tank Insulation.

O. Phenolic:

1. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
2. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
3. Factory-Applied Jacket: ASJ. Requirements are specified in "Factory-Applied Jackets" Article.

P. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Dow Chemical Company (The); Trymer 2000 XP.
   b. Duna USA Inc.; Corafoam.
   c. Dyplast Products; ISO-25.
   d. Elliott Company of Indianapolis; Elfoam.

2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.
3. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less for thickness up to 1 inch as tested by ASTM E 84.
4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

a. Equipment Applications: ASJ-SSL.

Q. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

R. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

2.2 ADHESIVES

A. Materials shall be compatible with jackets and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Dow Corning Corporation; 739, Dow Silicone.
   b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 MASTICS

A. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
   d. Mon-Eco Industries, Inc.; 44-05.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.
6. Color: White or gray.
7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering equipment.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for equipment.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated tank heads and tank side panels.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.

7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

a. Sheet and roll stock ready for shop or field sizing.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white stucco-embossed aluminum-foil facing.

F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 4 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 6 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.

3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1) AGM Industries, Inc.; CHP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place.

a. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers, Series.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.080-inch nickel-copper alloy.

2.11 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with anchor pins and speed washers.

1. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
2. Protect exposed corners with secured corner angles.
3. Install self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

    a. Do not weld anchor pins to ASME-labeled pressure vessels.
    b. Select insulation hangers that are compatible with service temperature and with substrate.
    c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    d. Do not overcompress insulation during installation.
    e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    f. Impale insulation over anchor pins and attach speed washers.
    g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
5. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
6. Stagger joints between insulation layers at least 3 inches.
7. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.

8. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from galvanized steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.5 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Boiler Breechings:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation material.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. On exposed applications without metal jacket, finish insulation surface with a skim coat of mineral-fiber, hydraulic-setting cement. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth. Thin finish coat to achieve smooth, uniform finish.

3.6 INSTALLATION OF PHENOLIC INSULATION

A. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.

B. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099000

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Commissioner. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections: Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 BREECHING INSULATION SCHEDULE

A. Round, exposed breeching and connector insulation shall be one of the following:

1. Calcium Silicate: 4 inches thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

B. Round, concealed breeching and connector insulation shall be one of the following:

1. Calcium Silicate: 4 inches thick.
2. High-Temperature Mineral-Fiber Blanket: 3 inches thick and 3-lb/cu. ft. nominal density.
3. High-Temperature Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

3.11 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment that is not factory insulated.

C. Heat-exchanger (water-to-water) insulation shall be one of the following:

1. Calcium Silicate: 3 inches thick.
2. Cellular Glass: 3 inches thick.
3. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
4. Mineral-Fiber Pipe and Tank: 2 inches thick.

D. Dual-service heating and cooling water pump insulation shall be one of the following:

1. Cellular Glass: 3 inches thick.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

3. Phenolic: 2 inches thick.

E. Radiant floor water pump insulation shall be one of the following:

1. Cellular Glass: 3 inches thick.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
3. Phenolic: 2 inches thick.

F. Thermal storage water tank insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.
3. Mineral-Fiber Pipe and Tank: 1 inch thick.
4. Phenolic: 1 inch thick.
5. Polyisocyanurate: 1 inch thick.
6. Polyolefin: 1 inch thick.

G. Dual-service heating and cooling water air-separator insulation shall be one of the following:

1. Cellular Glass: 1-1/2 inches thick.
2. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.
3. Mineral-Fiber Pipe and Tank: 1 inch thick.
4. Phenolic: 1 inch thick.
5. Polyisocyanurate: 1 inch thick.
6. Polyolefin: 1 inch thick.

H. Radiant floor water air-separator insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.
3. Mineral-Fiber Pipe and Tank: 1 inch thick.
4. Phenolic: 1 inch thick.
5. Polyisocyanurate: 1 inch thick.
6. Polyolefin: 1 inch thick.

I. Deaerator insulation shall be one of the following:

1. Calcium Silicate: 3 inches thick.
2. Cellular Glass: 3 inches thick.
3. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
4. Mineral-Fiber Pipe and Tank: 2 inches thick.

J. Piping system filter-housing insulation shall be one of the following:

1. Cellular Glass: 3 inches thick.
2. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.
3. Mineral-Fiber Pipe and Tank: 2 inches thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
1. PVC, Color-Coded by System: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.
3. Painted Aluminum, Smooth: 0.024 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.024 inch thick.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
1. PVC, Color-Coded by System: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.
3. Painted Aluminum, Smooth: 0.024 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.024 inch thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
1. Painted Aluminum, Smooth with 1-1/4-Inch- Deep Corrugations: 0.024 inch thick.
2. Stainless Steel, Type 304 or Type 316, Smooth, with 1-1/4-Inch- Deep Corrugations: 0.024 inch thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Concealed:
1. PVC, Color-Coded by System: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.
3. Painted Aluminum, Smooth: 0.024 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.024 inch thick.

D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Painted Aluminum, Smooth with Z-Shaped Locking Seam: 0.024 inch thick.
2. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish with Z-Shaped Locking Seam: 0.024 inch thick.

E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Painted Aluminum, Smooth with 1-1/4-Inch- Deep Corrugations: 0.032 inch thick.

2. Stainless Steel, Type 304 or Type 316, Smooth, with 1-1/4-Inch- Deep Corrugations: 0.024 inch thick.

END OF SECTION 230716

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors.
2. Dual-service heating and cooling piping, indoors
3. Radiant floor water piping, indoors
4. Ground source "Source Water" piping, indoors

B. Related Sections:

1. Section 230713 "Duct Insulation."
2. Section 230716 "HVAC Equipment Insulation."
3. Section 232113" Hydronic Piping" U/G piping included in Hydronic piping

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Provide a completed VOC submittal form per Section 01 81 13.

C. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

E. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use.

1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
2. Sheet Form Insulation Materials: 12 inches square.
3. Jacket Materials for Pipe: 12 inches long by NPS 2.
4. Sheet Jacket Materials: 12 inches square.
5. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

F. Product Pre-Review Documentation: Provide the following in compliance with Section 01 81 13 "Sustainable Design Requirements":
1. List of the materials or products that will be submitted under this Specification Section. All alternatives being considered shall be noted.
2. Product data detailing the material components of each assembly, if applicable.
3. Completed Materials Inquiry Forms for each material or product.
4. MSDS or other manufacturer data stating the chemical components of each product, including the Chemical Abstracts Service (CAS) numbers.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot section of NPS 2 straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
e. Four support hangers including hanger shield and insert.
f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Obtain Architect's approval of mockups before starting insulation application.
5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Low emitting materials: Adhesive, sealant, paint and coating products used within the vapor barrier shall comply with VOC limits in Section 01 81 19.

B. Comply with requirements in the Piping Insulation schedule included as part of this specification (or requirements of latest energy code, whichever is more stringent) for where insulating materials shall be applied.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

G. Calcium Silicate:

1. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
3. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

H. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Board Insulation: ASTM C 552, Type IV.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

I. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin; for operating temperature higher than 250 deg F. Comply with ASTM C 1290, Type I for insulation without jackets, Type II for insulation with vinyl jackets, and Type III for insulation with FSK or FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Friendly Feel Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; SOFTR All-Service Duct Wrap.

J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

K. Phenolic:

1. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
2. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
3. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
4. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

    a. Preformed Pipe Insulation: ASJ.

L. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Dow Chemical Company (The); Trymer 2000 XP.
   b. Duna USA Inc.; Corafoam.
   c. Dyplast Products; ISO-25.
   d. Elliott Company of Indianapolis; Elfoam.

2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F at 75 deg F after 180 days of aging.
3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thickness up to 1 inch as tested by ASTM E 84.
4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

   a. Pipe Applications: ASJ-SSL.

M. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.

N. Polystyrene: Rigid, extruded cellular polystyrene intended for use as thermal insulation for outdoor; its flame-spread/smoke-developed indexes are unsuitable for most indoor applications.. Comply with ASTM C 578, Type IV or Type XIII, except thermal conductivity (k-value) shall not exceed 0.26 Btu x in./h x sq. ft. x deg F after 180 days of aging. Fabricate shapes according to ASTM C 450 and ASTM C 585.

2.2 ADHESIVES

A. Materials shall be compatible with jackets and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Dow Corning Corporation; 739, Dow Silicone.
b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
c. P.I.C. Plastics, Inc.; Welding Adhesive.
d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Products: Subject to compliance with requirements, provide one of the following or approved equal:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide one of the following or approved equal:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.

2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, provide one of the following or approved equal:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    d. Mon-Eco Industries, Inc.; 44-05.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.

6. Color: White or gray.
7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

6. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

   a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.

a. Sheet and roll stock ready for shop or field sizing.
b. Material, finish, and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a

rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.

H. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 4 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.
5. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Width: 3 inches.
2. Film Thickness: 6 mils.
3. Adhesive Thickness: 1.5 mils.
4. Elongation at Break: 145 percent.

5. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips; of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for

above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.
3. Apply a skim coat of mineral-fiber, hydraulic-setting cement to insulation surface. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth or tape. Thin finish coat to achieve smooth, uniform finish.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.
4. Finish flange insulation same as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed insulation sections of insulation are not available, install mitered sections of calcium silicate insulation. Secure insulation materials with wire or bands.
3. Finish fittings insulation same as pipe insulation.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install mitered segments of calcium silicate insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
2. Install insulation to flanges as specified for flange insulation application.
3. Finish valve and specialty insulation same as pipe insulation.

3.7 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.
2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.

C. Insulation Installation on Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of polyisocyanurate insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.11 INSTALLATION OF POLYSTYRENE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation with tape or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.

3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, and make thickness same as adjacent pipe insulation, not to exceed 1-1/2-inch.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polystyrene block insulation of same thickness as pipe insulation.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed section of polystyrene insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.12 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.13 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

    a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Color: Final color as selected by Commissioner. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.15 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.16 PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
c. Phenolic: 1 inch thick.
d. Polyisocyanurate: 1 inch thick.
e. Polyolefin: 1 inch thick.

B. Dual-Service Heating and Cooling Water:

1. NPS 3 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.
d. Polyisocyanurate: 2 inch thick.

2. NPS 4 to NPS 12: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.
d. Polyisocyanurate: 2 inch thick.

3. NPS 14 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.

C. Radiant Floor Water:

1. NPS 12 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.
d. Polyisocyanurate: 2 inch thick.

2. NPS 14 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.

D. Ground Source "Source Water" Water:

1. NPS 12 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.
d. Polyisocyanurate: 2 inch thick.

2. NPS 14 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe, Type I or Pipe Insulation Wicking System: 2 inches thick.
c. Phenolic: 2 inches thick.
d. Polyisocyanurate: 2 inches thick.

3.17 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. PVC: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.
3. Painted Aluminum, Smooth: 0.024 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.020 inch thick.

D. Piping, Exposed:
1. PVC: 30 mils thick.
2. Aluminum, Smooth: 0.024 inch thick.
3. Painted Aluminum, Smooth: 0.024 inch thick.
4. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish: 0.020 inch thick.

3.18 PIPING INSULATION AND JACKET SCHEDULE

A. For all piping insulation and jackets, the following thermal properties must be maintained to comply with the energy code associated with New York City Code, Energy Code and LEED requirements. Where this schedule does not meet current code, current energy code requirements shall be met.

Piping System	Application	Insulation Type, Jacket Type	Insulation thickness and thermal rating
Dual-service, Indoor Rated, 3" and smaller	Concealed in Building	Indoor	1.5", 0.27 Btu*in/(h*ft2*F)
Dual-service, Indoor Rated, larger than 3"	Concealed in Building	Indoor	2", 0.27 Btu*in/(h*ft2*F)
Radiant floor Water, Indoor, 3" and smaller	Concealed in Building	Indoor	1.5", 0.27 Btu*in/(h*ft2*F)
Radiant floor Water, Indoor, larger than 3"	Concealed in Building	Indoor	2", 0.27 Btu*in/(h*ft2*F)
Condensate, Indoor	Concealed in Building	Indoor	1", 0.27 Btu*in/(h*ft2*F)
Ground source, Indoor, 1.5" and smaller	Concealed in Building	Indoor	1.5", 0.27 Btu*in/(h*ft2*F)
Ground source, Indoor, larger than 1.5"	Concealed in Building	Indoor	2", 0.27 Btu*in/(h*ft2*F)

END OF SECTION 230719

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 230800

COMMISSIONING OF HVAC AND PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

B. Section also includes commissioning process requirements for Plumbing Systems.

C. Related Sections:

1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

G. Provide City of New York/operator with minimum 2 weeks advanced notice of training for operator use of all equipment.

H. Provide CxA with 2-week construction progress look-aheads in order to allow for scheduling of Cx activities

I. Provide full sequence of operations documentation to CxA

J. Train building O&M personnel in systems operation (may be provided by system manufacturer where approved)

1.6 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Review of applicable contractor submittals before approval by design team and acquisition by contractor.

C. Direct commissioning testing.

D. Verify testing, adjusting, and balancing of Work are complete.

E. Verify appropriateness and completeness of training of building O&M personnel by contractor.

F. Provide test data, inspection reports, systems operating manuals and certificates in Systems Manual.

G. Review systems performance within 10 months after substantial completion, and develop a plan for resolving any outstanding commissioning related issues found.

1.7 COMMISSIONING DOCUMENTATION

A. Provide the following information to the CxA for inclusion in the commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 Testing AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 14 days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.

1. The CxA will notify testing and balancing Contractor or Subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. The testing and balancing Contractor or Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, full sequences of operation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC&R testing shall include entire HVAC&R and installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor or Subcontractor, and HVAC&R Instrumentation and Control Contractor or Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the City of New York. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in HVAC boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in HVAC piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of gas and hot-water systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

H. ERV and outdoor air units (all) Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, and hydronic distribution systems; heat recovery wheel and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

3.5 PLUMBING COMMISSIONING

A. Related Documents:
   1. Drawings and general provisions of the Subcontract apply to this Section.
   2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:
   1. General requirements that apply to implementation of commissioning of plumbing systems, assemblies and components.

C. Related Sections:
   1. Division 01 Section "General Requirements."
   2. Division 01 Section "Special Procedures."
   3. Division 22 Plumbing Sections.

3.6 REFERENCES

A. General:
   1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
   2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
   3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.
   4. Refer to Division 22 Section "Common Results for Plumbing" for codes and standards, and other general requirements.

3.7 DESCRIPTION

A. The purpose of commission is to ensure that work has been completed as specified and that systems are functioning in the manner as described in the specified system operating criteria. It will assist operating staff training and familiarization with new systems. It will serve as a tool

to reduce post-occupancy critical systems operational difficulty or failure. It will, also, be used to develop test protocol and record the associated test data in an effort to advance the building systems from a state of substantial completion to a full dynamic operation.

B. Commission will commence after preliminary punch list items are completed by Subcontractors.

C. The steps associated with commissioning are outlined below:
   1. Step One - Installation Verification
   2. Step Two - System Start-Up.
   3. Step Three – Functional Performance Testing.

D. Operational staff training is essential to the commission process and will run concurrently with steps one through three.

E. The Commissioning Team will include representatives of the Facility, Construction and Installing Subcontractors, Test and Balance Subcontractor, FMCS Subcontractor and Construction Subcontractor's Commissioning Agent. Equipment manufacturer's representatives will be present for start-up as specified in the equipment specification sections and for equipment training.

3.8 SYSTEMS TO BE COMMISSIONED

A. Commissioning will be performed on the following systems:
   1. Facility Monitoring and Control System (FMCS)
   2. Hot Water System.
   3. Storm Water Reclamation Skid
   4. Booster Pumps
   5. Circulating Pumps
   6. Sewage and Storm Water Pumps

3.9 SUBMITTALS

A. Submit under provisions of Division 01 Section "General Requirements."

B. Commissioning Plan as prepared by the prime Subcontractor or his Commissioning Agent.

C. Prime subcontractors or his Commissioning Agent shall provide Functional Performance Tests (FPT) procedures for the above listed systems. Prime subcontractors or his Commissioning Agent shall provide system narrative descriptions as part of the FPT procedures.

3.10 Commissioning plan

A. The commissioning plan shall outline the organization, scheduling, team members, and documentation pertaining to the overall commissioning process.

3.11 NARRATIVE DESCRIPTIONS

A. A narrative description of the design intents of the systems and their intended modes of sequences of operation.

3.12 FUNCTIONAL PERFORMANCE TESTS (FPT) PROCEDURES

A. General Requirements

1. This section provides brief descriptions of the testing and support the Installer and installers will be required to provide to perform the functional testing of the equipment for the project.
2. The Cx Authority will further define the tests and procedures in the Testing and Acceptance Modules as well as the individuals required to support the testing.

B. Domestic Water Production

1. The contractor(s) will be required to demonstrate all safeties (personnel and mechanical e.g. loss of flow, high temperature, etc.); local device operation; any local controls including temperature control; and integrated 3rd party Building Management System controls including all related devices and sequence of operations.

C. Pumping Equipment

1. The installer(s) and the manufacturer's representative will be required to demonstrate that all pumps are properly aligned, the pumps operate in the proper direction and that the overload protective devices are installed properly and set to the proper settings.
2. The installer(s) will be required to demonstrate in writing (TAB Report) that the pumps are balanced to achieve the specified design flows, including motor performance data as specified in the TAB specifications.

3. The controls representative will be required to demonstrate that the pumps can start, stop, modulate speed (if required) and the lead/lag sequence performs as per the sequence of operations.
4. A PC representative will be required to manually operate all hand valves.

3.13 GENERAL

A. The Subcontractors shall be responsible for performing procedures presented in specification and contract drawings as detailed in the Functional Performance Tests (FPT). Members of the designated Commissioning Team shall witness various portions of the commissioning process. Responsibilities for these activities are listed in the following paragraphs. Commissioning Team members shall sign-off on appropriate sections after verifying installation, operation, or documentation. Final sign-off shall be by the Facility and Commissioning Agent.

B. Any test ports, gauges, test equipment, etc., needed to accomplish the functional performance tests shall be provided by Subcontractors.

C. Subcontractors shall provide to the Commissioning Team documentation of calibration of controls. Documentation shall include dates, setpoints, calibration coefficients, control loop

verification, and other data required to verify system check-out. Documentation shall be dated and initialed by field engineer or technician performing the work.

3.14 OPERATIONAL STAFF TRAINING

A. System narrative descriptions will be prepared by the Commission Agent and supported by flow diagrams, one line diagrams, and appropriate specification sections for major systems to be commissioned. The Commission Agent will coordinate "system description" meetings with members of facility management and maintenance department groups to review system description documentation. The meetings will provide an overview of major system features, components, and arrangements.

B. The Subcontractor and associated manufacturer's representatives shall provide required training to operational staff after the system description meetings have occurred. The Subcontractor training sessions shall provide a more detailed analogy of systems operation and maintenance.

3.15 INSTRUMENTATION

A. Instrumentation will be provided by the Subcontractor. Instruments used for measurements shall be accurate. Calibration histories for each instrument shall be available for examination. Calibration and maintenance of instruments shall be in accordance with the requirements of NEBB or AABC Standards.

B. Application of instruments and accuracy of measurements shall be in accordance with NEBB or AABC Standards.

3.16 DOCUMENTATION

A. The installing Subcontractor shall be responsible for collection of pertinent data during system start-up and functional performance testing. The Subcontractor shall submit to the Commissioning Agent documentation of tests performed prior to and after system start-up. Documentation shall also include start-up procedures as approved by Commissioning Team.

B. Documentation is to be typewritten on 8-1/2 by 11 inches (200 by 280 mm) paper and inserted in a 2 inches (50 mm) to 3 inches (75 mm) thick three ring binder. Indicate the project name, number, volume number, and volume title on the end panel of each binder.

C. Provide a title sheet for each volume and list the following:
   1. Volume Title and Section Name and Number requiring this submittal.
   2. Project name, project number, and address.
   3. Subcontractor name, address, and phone number.
   4. Name, title, signature, and date of person making the submittal.
   5. Name of Facility, a blank line for signature, and the date of person accepting the submittal.
   6. Name, address, and phone number of Commission Agent; a blank line for signature; and date of person accepting the submittal.

D. Provide a Table of Contents for multiple submittals. List each submittal and page number. Number each page, centered on the bottom in sequential numerical order. Provide tabs for multiple submittals in a single binder.

3.17 STEP ONE - INSTALLATION VERIFICATION

A. General Commissioning responsibilities:
   1. Before system start-up begins, the Commission Team shall conduct a final installation verification audit. The Subcontractor shall be responsible for completion of work including change orders and punch list items to the Facility's satisfaction. The audit shall include, but not be limited to, checking of:
      a. Piping specialties including balance, control, and isolation valves.
      b. Ductwork specialty items including turning devices, balance, fire, smoke, control dampers, and access doors.
      c. Control sensor types and location.
      d. Identification of piping, valves, equipment, controls, etc.
      e. Major equipment, pumps, valves, starters, gauges, thermometers, etc.
      f. Documentation of prestart-up tests performed, including manufacturer's factory tests.
   2. If work is found to be incomplete, incorrect, or non-functional, the Subcontractor shall correct the deficiency before system start-up work proceeds.

3.18 STEP TWO – SYSTEM START UP

A. General Commissioning Responsibilities:
   1. A start-up plan shall be developed and submitted by the installing Subcontractor. Start-up plan to include the following:
      a. Flushing and cleaning of pipe.
      b. Filters, strainers, and screens.
      c. Valve/damper positions.
      d. Electrical tests.
      e. Pressure tests.
      f. Safeties.
      g. Chemical treatment.
      h. Manufacturer's tests.
   2. The start-up plan will be reviewed and a prestart-up inspection performed by designated members of the Commissioning Team. The installing Subcontractor shall commence with system start-up after approval has been given to start-up plan and the prestart-up inspection is completed. Designated members of the Commissioning Team shall witness system start-up and list system and equipment deficiencies noted during start-up. The Subcontractor shall take corrective action on system deficiencies noted and demonstrate to the Commissioning Team members suitable system operation.
   3. Designated systems requiring test and balance work shall have this activity commence after systems have successfully completed start-up. System and equipment deficiencies observed during this activity is to be noted and corrected.

3.19 STEP THREE - FUNCTIONAL PERFORMANCE TESTING

A. General Commissioning Responsibilities:
   1. Functional Performance Testing begins after operational testing, adjusting, and balancing of the systems have been completed by the Subcontractors; and the System Description and Hands-on Training sessions have been completed.
   2. The objective of the Functional Performance Testing is to advance the building systems from a state of substantial completion to full dynamic operation in accordance with the specified design requirements and design intent.
   3. Attaining this object will be accomplished by developing individual systems testing protocols which, when implemented by the Subcontractor, will allow the Commissioning Team to observe, evaluate, identify deficiencies, recommend modifications, tune, and document the systems and systems equipment performance over a range of load and functional levels.
   4. Functional Performance tests for the systems to be commissioned are defined in the Commissioning Plan. These tests are intended to be conclusive but may require minor modifications as system operation dictates.

3.20 DEFERRED TESTING

A. Unforeseen Deferred Tests – If any inspection or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of inspections and functional testing may be delayed upon approval of the PM or City of New York. These tests will be conducted in the same manner as the seasonal test as soon as possible. Services of necessary parties will be negotiated.

B. Seasonal Testing – During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate CTRs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

END OF SECTION 230800

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 230900

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 WORK INCLUDED

A. Furnish a totally native BACnet-based system, including an operator's workstation using Microsoft Windows 2000 Professional or XP Professional as the operating system and shall be based on a distributed control system in accordance with this specification. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2001, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

B. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

C. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

D. Provide and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

E. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

F. Provide and install all power wiring to control panels and control devices requiring power.

G. Provide interconnecting control wiring for mechanical, electrical and plumbing systems as specified herin.

H. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

I. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

J. Provide a comprehensive operator and technician instruction program as described herein. Contractor to provide two weeks' notice to the City of New York and commissioning agent for the date of all instruction for all systems.

K. Provide as-built documentation, full sequence of operations, operator's interface head end PC software, dedicated workstation, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

L. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

M. All standard, devices and system set up shall conform to City of New York procedures and standards.

1.3 SYSTEM DESCRIPTION

A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2001, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as electric duct heaters, AC units, etc. and all air handlers, boilers, chillers, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

B. Operator's workstation software shall be Microsoft Windows 2000 Professional or XP Professional as the computer operating system. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software functions delivered on this project shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited. All software required to program application specific controllers and all field level devices and controllers will be left with the City of New York. All software passwords required to program and make future changes to the system will also become the property of the City of New York. All software required to make any program changes anywhere in the system along with scheduling, and trending applications will be left with the City of New York. All software passwords required to program and make future changes to schedules, trends and related program changes will also become the property of the City of New York. All software required for all field engineering tools including graphical programming and applications will be left with the City of New York. All software passwords required to program and make future

changes to field engineering tools including graphical programming and applications will be left with the City of New York.

C. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator interface panel. Operator interface panel software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.

D. All application controllers for every terminal unit (AC Unit, etc.) air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.

E. Room sensors shall be provided with digital readout that allows the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to start and stop unit from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode. Field service mode shall allow technician to balance VAV zones and access any parameter in zone controller.

1. All control equipment used to perform any or all of the specified smoke control sequences shall be UL-864 UUKL listed. This includes all field controllers and global control devices. Non UUKL rated equipment shall not be networked to any devices on the network performing smoke control sequences unless isolated by a UUKL rated device. See drawings for actual sequence of operations.

1.4 APPROVED MANUFACTURER

A. Johnson Controls by HTSny

B. Alerton

C. Siemens

D. Approved equal

1.5 QUALITY ASSURANCE

A. The Building Management System (BMS) shall be engineered and installed, commissioned and serviced by factory trained personnel. BMS contractor shall have an in-place support facility within 2 hours response time of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment.

B. The BMS contractor shall provide full time, on site, experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the BMS system.

C. The Installer shall be regularly engaged in the installation and maintenance of BMS systems and shall have demonstrated technical expertise and experience in the installation and maintenance of BMS systems similar in size and complexity to this project. Installers shall provide projects, similar in size and scope to this project completed within the past 3 years.

D. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

E. All BMS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.

F. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

1.6 REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

3. ANSI/ASHRAE Standard 135-2001, BACnet.

4. Uniform Building Code (UBC), including local amendments.

5. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.

6. National Electrical Code (NEC).

7. FCC Part 15, Subpart J, Class A

8. EMC Directive 89/336/EEC (European CE Mark)

9. UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences

10. City, county, state, and federal regulations and codes in effect as of contract date.

B. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.7 SUBMITTALS

A. Drawings

B. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.

C. Drawings shall be submitted in the following standard sizes: 11" x 17" (ANSI B).

D. Eight complete sets (copies) of submittal drawings shall be provided.

E. Drawings shall be available on CD-ROM.

F. System Documentation

1. Include the following in submittal package:

2. System configuration diagrams in simplified block format.

3. All input/output object listings and an alarm point summary listing.

4. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.

5. Complete bill of materials, valve schedule and damper schedule.

6. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.

7. Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.

8. For all system elements—operator workstation, building controller(s), application controllers, routers, and repeaters,—provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.

9. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.

10. A list of all functions available and a sample of function block programming that shall be part of delivered system.

G. Project Management

1. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.

H. BACnet Device Object Naming Conventions

1. The BMS manufacturer's representative shall submit a BACnet Device Object Naming Convention Plan (DONCP) to the City of New York and consulting engineer during the submittal process. The plan must be approved by the Commissioner and consulting engineer prior to implementation. It is the responsibility of the BMS contractor to coordinate the DONCP with the Commissioner and consulting engineer.
2. The DONCP shall be designed to eliminate any confusion between individual points in a facility/campus wide EMCS system. It will also be designed to allow for future expansion and consistency. Each device on a BACnet internetwork (including other manufacturer's devices) must have a unique device instance. This is a major consideration when adding to an existing system or interconnecting networks. Thorough and accessible site documentation is critical.
3. A consistent object (point) naming convention shall be used to facilitate familiarity and operational ease across an eventual large campus or inventory of facilities. The following section is designed as recommendations only. It is the responsibility of the BMS contractor to coordinate the DONCP with the Commissioner and consulting engineer.
4. BACnet requires that all devices have a Device object name that is unique throughout the entire work. To comply with this requirement all BACnet devices should be configured with a Device Object Name that is based on the naming conventions described in this section. This includes all physical devices as well as any logical BACnet devices that are represented by gateways. The vendor shall coordinate with the Commissioner's staff to ensure that the correct names are used. Device Object Name properties shall support strings of at least 50 characters in length.

5. Network numbers - Identifies the network to which a BACnet device belongs. Every network on a BACnet LAN has a unique numerical identifier—a network number. This network number is used by BACnet devices only; it does not rely on nor does it affect any other network protocols. LANs connected by a router must have different network numbers. No interconnected BACnet networks can have the same network number. Network number range is 1–65534, for a maximum of 65534 interconnected BACnet networks.

6. MAC addresses - Hardware-oriented. The MAC address uniquely identifies a device on its particular network. Each network type—Ethernet and MS/TP—has its own MAC addressing scheme. A device that exists on two or more networks will have a MAC address for each one. Devices can have the same MAC addresses as long as they are on networks with different network numbers.

7. Ethernet devices - For Ethernet LANs, the IEEE assigns a certain range of MAC addresses to manufacturers of Ethernet products. Manufacturer then assigns a unique MAC address to each of its Ethernet devices.

8. MS/TP devices - For devices on an MS/TP LAN, you assign the MAC address for each controller. For BACtalk VLCs, these are assigned with DIP switches. Devices on an MS/TP LAN are designated as either masters or slaves, which

affects how they can be addressed. This is a requirement of the BACnet specification. All BACtalk MS/TP devices are masters.

9. Device instances - Software-oriented. The device instance identifies the device to the BACnet software and is the address most often encountered. The device instance is a shortcut to having to specify a MAC address and network number each time an operation is performed. Device instances range from 0–4194302.

1.8 GUARANTEE

A. Guarantee shall cover all costs for labor, associated travel, and expenses for a period of one year from completion of system acceptance.

B. Hardware and software personnel supporting this guarantee agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday, 48 hours on Saturday and Sunday.

C. This guarantee shall apply equally to both hardware installed by this labor and software.

1.9 RELATED WORK IN OTHER SECTIONS

A. Refer to DDC General Conditions for related contractual requirements.

B. Refer to Section 230100 for General Mechanical Provisions

C. Refer to Section 260500 for General Electrical Provisions

PART 2 - PRODUCTS

2.1. NETWORK ARCHITECTURE

A. Building Intranet Network

1. The BMS contractor shall be responsible for installation of primary and secondary LAN's required to support the complete BMS system. The Operator Workstation for the building shall be located as advised by the Commissioner.

B. BACnet Primary LAN

1. Primary LAN for the building automation system shall consist of a high speed network utilizing BACnet over Ethernet or BACnet/IP. The Primary LAN shall be used for communications between BACnet B-BC devices, B-AAC devices, B-ASC devices, and the Operator Workstation.

C. BACnet Secondary LAN

1. A secondary LAN, separate from the Primary LAN shall be used for communications between B-ASC devices and the B-BC or B-AAC that provides BACnet router services for the device. The Secondary LAN shall utilize BACnet MS/TP for communications. The intent of the separate Primary LAN and

Secondary LAN is to isolate traffic between B-BC's or B-AAC's and their associated B-ASC devices from the primary LAN.

2.2 BROWSER BASED OPERATOR INTERFACE

A. The system shall be capable of supporting an unlimited number of clients using standard Web browser such as Internet Explorer. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the Building Automation System (BAS), shall not be acceptable.

C. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, notice of access failure shall be displayed. Security using authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
3. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
4. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
    a) Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
5. Modify common application objects, such as schedules and setpoints in a graphical manner.
6. Commands binary objects to start and stop.
7. View logs and charts.
8. View alarms.
9. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

D. Alarms
1. Alarm feature shall allow user configuration of criteria to create, route, and manage alarms and events. It shall be possible for specific alarms from specific points to be routed to specific alarm recipients. The alarm management portion of the user interface shall, at the minimum, provide the following functions:

a. Allow configuration to generate alarms on any numeric, binary, or data point in the system.
b. Generate alarm records that contain a minimum of a timestamp, original state, acknowledged state, alarm class and priority.
c. Allow the establishment of alarm classes that provide the routing of alarms with similar characteristics to common recipients.
d. Allow a user, with the appropriate security level, to manage alarms - including sorting, acknowledging, and tagging alarms.

E. Reports and Summaries

1. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
   a. All points in the BAS
   b. All points in each BAS application
   c. All points in a specific controller
   d. All points in a user-defined group of points
   e. All points currently in alarm
   f. All BAS schedules
   g. All user defined and adjustable variables, schedules, interlocks and the like.

2. Reports shall be exportable to .pdf, .txt, or .csv formats.
3. The system shall allow for the creation of custom reports and queries.
   11.

F. Schedules

1. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
   a. Regular schedules
   b. Repeating schedules
   c. Exception Schedules

2. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.

3. It shall be possible to define one or more exception schedules for each schedule including references to calendars

4. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days. Holidays and special days shall be user-selected with the pointing device or keyboard.

G. Password

1. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, Based on an assigned password.

2. Each user shall have the following: a user name, a password, and access levels.

3. The system shall provide the capability to require a password of minimum length and require a combination of characters and numerical or special characters.

4. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.

5. The system shall provide unlimited flexibility with access rights. A minimum of four levels of access shall be provided along with the ability to customize the system to provide additional levels.

6. A minimum of 100 unique passwords shall be supported.

7. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

8. The system shall automatically generate a report of log-on/log-off and system activity for each user.

9. All log data shall be available in .pdf, .txt, and .csv formats.

5. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.

6. It shall be possible to define one or more exception schedules for each schedule including references to calendars

7. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days. Holidays and special days shall be user-selected with the pointing device or keyboard.

H. Dynamic Color Graphics

1. The graphics application program shall be supplied as an integral part of the User Interface.

2. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.

3. The graphics shall be able to display real-time data that is acquired, derived, or entered.

4. Graphics runtime functions –Each graphic application shall be capable of the following functions:

   a. All graphics shall be fully scalable
   b. The graphics shall support a maintained aspect ratio.
   c. Multiple fonts shall be supported.

d. Unique background shall be assignable on a per graphic basis.

5. Operation from graphics – It shall be possible to change values (setpoints) and states in systems controlled equipment within the Web browser interface.

6. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all runtime binding.

I. Historical Data Collection

1. All numeric, binary or data points in the system database shall allow their values to be logged over time (trend log). Each historical record shall include the point's name, a time stamp including time zone, and the point's value.

2. The configuration of the historical data collection shall allow for recording data based on change of value or on a user-defined time interval.

3. The configuration of the historical data collection shall allow for the collection process to stop or rollover when capacity has been reached.

4. A historical data viewing utility shall be provided with access to all history records. This utility shall allow historical data to be viewed in a table or chart format.

5. The history data table view shall allow the user to hide/show columns and to filter data based on time and date. The history data table shall allow exporting to .txt, .csv, or .pdf file formats.

6. The historical data chart view shall allow different point histories to be displayed simultaneously, and also provide panning and zooming capabilities.

J. Audit Log

1. For each log entry, provide the following data;

2. Time and date

3. User ID

4. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

K. Database Backup and Storage

1. The user shall have the ability to backup the System Controller databases.

2.3 BUILDING CONTROLLERS

A. BACnet Devices

1. Network Area Controller (NAC)

a The NAC must provide the following hardware features as a minimum:

1) Communications
   a) One 10/100 Mb Ethernet Port – RJ-45 connection
   b) One RS-232 port
   c) One RS-485 port (up to 57,600 baud)
   d) Optional internal auto-dial/auto-answer 56K modem.All required protocol drivers are included.
2) Inputs/Outputs
   a) Four form C SPDT relay outputs rated for 24 VAC/DC @ 2Amps resistive each with individual LED indicators
   b) Six Universal Inputs for 10K NYC, 4-20 mA, 1-10 V, Dry contact
3) Battery Backup
   a) Battery backup provided for all on board functions including I/O
   b) Battery is monitored and trickle charged
   c) Battery maintains processor operation through power failures for a pre-determined interval, and then writes all data to flash memory, shuts the processor down, and maintains the clock for five years.
4) Environment
   a) Must be capable of operation over a temperature range of 0°C to 55°C.
   b) Must be capable of withstanding storage temperatures of between 0°C and 70°C.
   c) Must be capable of operation over a humidity range of 5% to 95% RH, non-condensing
5) Performance
   a) Supports up to 100 devices.

2. The Network Area Controller (NAC) shall be a fully user-programmable device capable of providing all of the capability described in Section 2.3 Part A.

a Automation network – The Network Area Controller (NAC) shall reside on the automation network. Each NAC shall support one or more sub-networks of controllers.

b User Interface – Each Network Area Controller (NAC) shall have the ability to deliver a web based user interface as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

c Power Failure – In the event of the loss of normal power, The Network Area Controller (NAC) shall continue to operate for a define period after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software. Flash memory shall be incorporated for all critical controller configuration data.

d During a loss of normal power, the control sequences shall go to the normal system shutdown conditions.

e Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

f Certification – All controllers shall be listed by Underwriters Laboratories (UL).

3. Advanced Application Controller

a Control of AO's and BO's and monitoring of AI's and BI's are permitted on devices that conform to the requirements for the BACnet Advanced Application Controller (B-AAC) as identified in ASHRAE Standard 135. B-ASC's shall be provided with all supporting BACnet services as a local function. The device shall not depend upon any other devices for the functionality of schedule or alarm activities. Alternatively, the B-ASC's or B-BC's that the device is dependent upon shall utilize an Uninterruptible Power Supply (UPS). A single piece of equipment shall utilize a single controller. Control functions for a single piece of equipment may not be divided among controllers.

4. Application Specific Controllers

a Control of AO's and BO's and monitoring of AI's and BI's are permitted on devices that conform to the requirements for the BACnet Application Specific Controller (B-ASC) as identified in ASHRAE Standard 135. Where B-ASC's are utilized, any supporting B-BC or B-ASC must be provided with an Uninterruptible Power Supply (UPS) to avoid any unintentional loss in the support of BACnet services due to a power outage for the B-BC while the B-ASC is functional.

5. Gateways

a Gateways between BACnet and any other protocols shall not be allowed for this project.

6. Smart Sensor/Actuator

a BACnet Smart sensors (B-SS) and actuators (B-SA) shall not be permitted for use on this project. All system I/O must be connected directly to a B-AAC or B-ASC device.

2.4 SENSORS AND MISCELLANEOUS DEVICES

A. General - Field Devices

1. The project that is the subject of this specification may not require all types of hardware listed in this section.
2. Provide field devices for input and output of digital (binary), and analog, signals into BACnet devices. Provide signal conditioning and/or filtering for all field devices as recommended by field device manufacturers, and as required for proper operation of the system.
3. It the responsibility of the building automation contractor to provide equipment as identified in this specification section. This section may identify devices which are not required to be provided in the scope of this project (i.e. The ep transducer is included in this section, but may not be required on a project where all electric controls are found).
4. It shall be this building automation contractor's responsibility to assure that all field devices are compatible with the controllers to be used on the project.
5. Transmitters specified herein are generally 4-20 ma "two-wired" type transmitters, with power for the device expected to be supplied from the transformer powering the controller.
6. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, the building automation contractor shall furnish and install proper device. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.
7. Accuracy, as stated in this section, shall include combined effects of non-linearity, non-repeatability and hysteresis.

B. Temperature Sensors

1. Sensor range: when matched with a/d converter of the controller, sensor range shall provide a resolution of no larger than .4°f (unless noted otherwise).

2. Room temperature sensor shall be an element contained within a ventilated cover, suitable for wall mounting. Sensors located in mechanical areas, plenums, garages, or designated institutional locations shall be a flat plate sensor with no possible adjustment. Security screws shall be used in institutional settings as deemed necessary by the design engineer. The building automation contractor shall coordinate requirements with the design engineer during the submittal process. Provide an insulated base when used on an outside wall, on an interior wall within 18 inches of an outside wall, or on a wall adjacent to an unconditioned space. The following sensing elements are acceptable:

   a. Sensing element - platinum RTD, thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.

C. Intelligent room sensor with LCD readout

1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also

allow service technician access to hidden functions as described in sequence of operation.

2. Intelligent room sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.

3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "off" in unoccupied mode unless a function button is pressed.

4. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.

5. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to vav controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

D. Single point duct temperature sensor

1. Single point duct temperature sensor shall consist of sensing element, junction box for wiring connections and gasket to prevent air leakage or vibration noise. Temperature range as required for resolution indicated in paragraph (a) below. Sensor probe shall be 300 or 400 series corrosion resistant steel (cres).

2. Sensing element - platinum RTD, thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.

E. Single point duct temperature sensor

1. Averaging duct temperature sensor shall consist of an averaging element, junction box for wiring connections and gasket to prevent air leakage. Provide enough sensors to give one lineal foot of sensing element for every three square feet of cooling coil face area. Temperature range as required for resolution indicated in paragraph (2) below.

2. Sensing element - platinum RTD, thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point.

F. Liquid immersion temperature sensor

1. Liquid immersion temperature sensor shall include stainless steel (or brass for copper piping) thermo well, sensor and connection head for wiring connections.

2. Sensing element for chilled water applications - platinum RTD, thermistor, or integrated circuit, +/- 0.8°F accuracy at calibration point. Temperature range shall be as required for resolution indicated in paragraph 3.

3. Sensing element for non-chilled water applications - platinum rtd, +/- 0.2°Faccuracy at calibration point. Temperature range shall be as required for resolution of no worse than 0.1°F.

G. Outdoor air condition sensor

1. Outside air temperature and humidity station shall consist of a single device with a ventilated non-metallic sun shield, utility box for terminations, and water tight gasket to prevent water seepage. These devices shall be mounted at least 10 feet above ground level in a north-facing location that is not exposed to the draft from an exhaust fan, cooling tower exhaust, AHU relief air, flue vent from a gas combustion heater, or any source of conditioned air. In the event a suitable wall mounting location cannot be found, the devices may be mounted in an open location provided they are supplied with a housing intended for mounting in such a location. Temperature range shall be as required for resolution indicated in paragraphs (a) and (b) below.

2. Sensing element - platinum RTD, thermistor, or integrated circuit, +/- 0.4°F temperature accuracy at calibration point.

3. Accuracy (% rh): +/- 3% 0-100% rh at 68°F, including hysteresis, linearity and repeatability.

H. Humidity transmitters

1. Units shall be suitable for duct, wall (room) or outdoor mounting. Unit shall be two-wire transmitter utilizing bulk polymer resistance change or thin polymer film capacitance change humidity sensor. Unit shall produce linear continuous output of 4-20ma for percent relative humidity (% rh). Sensors shall have the following minimum performance and application criteria:

2. Input range: 0 to 100% RH

3. Accuracy (% RH): +/- 2% 0-100% RH at 68°F, including hysteresis, linearity and repeatability.

I. Differential pressure sensor, air

1. The differential pressure sensor for air applications shall provide a current or voltage signal (4-20 ma, 0-10 vdc, or 0-5 vdc) with an accuracy of +/- 1% fs (including non-linearity, hysteresis, and non-repeatability). Accuracy for pressure sensors used in flow measurement applications shall be +/- 0.5%. Operating temperature range and compensated temperature range shall be as appropriate for the temperature extremes of the environment where it is used and the application it is intended for.

J. Differential pressure sensor, water

1. Sensor shall be two-wire 4-20 ma output kele & associates model 160c with a 5-valve manifold (kele bva-5) or a similar sensor and manifold from veris industries.

K. Fluid flow meters

1. Differential pressure-sensing insertion style flow meters (air or water) or dual-turbine impeller style insertion flow meters shall be used to monitor flow. The insertion style liquid flow sensors shall be as manufactured by Rosemount (Annubar) or Onicon (f-1210 or f-1211). Air flow sensing tubes may be mounted in the fan inlet as approved by the manufacturer for AHU applications.

2. as an alternative; provide non intrusive flow measuring device similar to ultra sonic Controlotron meters model 1010. refer to manufacturer for recommendation installation, control and accessories.

L. Airflow Measuring Stations

1. Airflow measuring stations required to accomplish the specified control sequence shall be furnished under this section but installed under the sheet metal section. Airflow measuring stations shall be of heavy gauge metal construction, and shall be furnished with an air straightening section with an open face area of not less than 97%.

2. Each airflow measuring station shall measure airflow by means of a network of static and total pressure sensors factory positioned and connected in parallel to produce an averaged velocity pressure. The measured velocity pressure converted to airflow (CFM) shall have an accuracy of 2% of the full scale throughout the velocity range from 700 to 4,000 FPM when measured under ideal laboratory conditions. The location of stations shall meet manufacturer's guidelines.

3. The maximum resistance to airflow shall not exceed 0.6 times the velocity head. The unit shall be suitable to withstand temperatures up to 250°F.

4. All interconnecting tubing between the air measuring and any remote metering or control shall be furnished and installed by the supplier of the station. A minimum of one static and one total pressure sensor shall be used for every 16 sq. Inches of duct cross sectional area for ducts up to four sq.ft. In cross section. For larger ducts, a minimum of one static and one total pressure sensor shall be used for every 36 sq. Inches of duct cross sectional area.

5. Interconnecting sensor manifolds shall equalize and relate each type of sensor measurement into one total pressure and one static pressure metering port. The permanent system pressure loss created by the unit shall not exceed .15 of a velocity head. Each airflow measuring station shall consist of 16-gauge sheet metal casing and an air straightening section with an open face area not less than 97%. The sheet metal contractor shall install air measuring stations.

6. Provide air monitor Fan-E or equal with an accuracy of + 2%, a turndown of 6 to 1, and no pressure loss across the station.

7. Final locations to be coordinated with sheet-metal contractor and manufacturer to ensure installed actual accuracy meets specifications.

M. Current switches

1. Current switch (input only) shall consist of 0 to 135 a continuous amperage rating, adjustable trip set-point to +/- 1% of range, .1a @ 110 vac resistive rating. Direct drive motors are permitted to utilize a current switch without an adjustable setpoint. Non direct-drive motors shall utilize a device with an adjustable setpoint as well as status and power led indication.

2. Current switch and load control relay (input/output device) shall consist of 0 to 135 a continuous amperage rating current switch, adjustable trip set-point to +/- 1% of range, .1a @ 110 vac resistive rating. Load control relay shall be capable of 5a @ 240 vac resistive. The device shall have adjustable trip setpoint as well as status, power, and relay command status led indication.

3. Current switches for VFD-controlled loads shall be specifically designed for this purpose. A Veris H-934 or approved equivalent device shall be used.

N. Damper end switch

1. Damper end switches shall be devices that directly detect the desired position of the damper blades. The switch shall not be a component of the actuator nor shall it be mounted on the damper shaft. The end switch shall be as manufactured by square d, Allen Bradley, cutler hammer, or approved equal.

O. Air Differential Pressure Switch

1. Air differential pressure switches shall be diaphragm type, die-cast aluminum housing, adjustable set point, with a SPDT switch. Rating shall be a minimum of 5 amps at 120 vac. Switch pressure range shall be suited for the application. Provide Dwyer or equal.

P. Low Temperature Detector (Freeze-Stat)

1. Low temperature detector (LTD) shall be automatic reset, DPDT type. LTD shall be installed in a serpentine fashion across the coil in the air stream in accordance with the manufacturer's recommendations. Element shall be arranged to lock out the associated fan should the temperature at any point along the sensing element fall below 35 °f for an adjustable time period.

Q. Single Point Leak Detector

1. Provide Liebert lt-410 or equal. The alarm module shall indicate that water has contacted the sensors by actuating two output relays. The relays shall remain activated until the module is reset.

R. Zone Leak Detector

1. Provide Liebert lt-460 or equal. The alarm module shall indicate that water has contacted the sensors cable by actuating two output relays. The relays shall remain activated until the module is reset.

S. Carbon Dioxide Sensor

1. Sensor shall employ non-dispersive infrared technology. (N.D.I.R.)

2. Sensor repeatability shall be +/- 20 ppm +/- 1% of measured value.

3. Sensor accuracy shall be +/- 30ppm +/-5% of measured value.

4. Sensor response time shall be less than 1 minute.

5. Sensor shall employ reference channel design for long-term stability.

6. Sensor shall have field selectable 0-10vdc, 0-5vdc, or 4-20ma output.

7. Sensor power requirement shall be less than 3w.

8. Sensor input voltage shall be 20 to 30vac/dc.

9. Sensor operating temperature range shall be 32oF to 122oF.

10. Sensor shall be Johnson Controls model CDL or equal.

11. Sensor shall have a field programmable set-point relay.

T. Room Pressure Monitor

1. The room pressure monitoring system shall be as described below:

2. Acceptable Manufacturers: Tek-Air Systems, Inc., Iso-Tek room pressure monitor, TSI Incorporated Model 8630-SM PRESSURA Room Pressure Monitor or equal.

3. The system shall include the Room Pressure Monitor, sensing probes, special cables, and special mounting hardware as required.

U. Room Pressure Monitor;

1. Shall consist of a transmitter module and two sensing probes. The transmitter module shall be mounted above the ceiling line, in the corridor adjacent to the room to be monitored.

2. Room sensing probes shall be mounted adjacent to the doorway. Reference probes shall be mounted in the hallway.

3. The transmitter module shall be microprocessor based and shall include the air velocity sensor. The transmitter module shall be powered by 24VAC. It shall be provided with a 4-20mA analog output, a SPDT alarm relay output.

4. The pressure sensor shall accurately measure room pressure from -0.20000 to +0.20000 inches H2O. The sensor shall be accurate to 2% of range. The sensor shall be bi-directional to determine the proper direction of pressure.

5. The transmitter module shall be provided with two wire communications for interface to the BMS via an open protocol. The controller shall be capable of communicating the transfer air velocity, high and low alarm conditions, and high and low alarm settings to a remote digital system. The BMS shall be capable of transmitting high and low alarm set points.

V. Room Alarm Status Display;

1. A wall mounted display module shall be provided to alert staff to the presence of an unsafe pressure condition. The display module shall incorporate lights to indicate the following conditions:

2. Red - ALARM conditions. Red shall indicate the pressure is outside of alarm tolerances, the current flow direction, and relative magnitude.

3. Green - NORMAL or safe pressure condition. Green shall indicate the pressure is within alarm tolerances.

4. The module shall have an audible alarm horn and an alarm mute (acknowledge) button.

5. Alarm limits shall be capable of being set at the display module.

6. An audible alarm horn shall be provided. When an alarm condition occurs and exceeds the selected time delay period, the alarm horn shall sound. Personnel may then silence the horn by pressing the Mute button.

7. The display module shall be capable of being mounted on a standard, 4"x 4" handi-box, and shall include tamper proof screws for mounting. The monitor shall be capable of being mounted up to 50 feet from the transmitter module.

W. Electric control components

1. Limit switches (LS): limit switches shall be UL listed, with adjustable trim arm. Limit switches shall be as manufactured by Square "D", Allen Bradley or approved equal; SPDT or DPDT type.

2. Control relays: all control relays shall be UL listed, with contacts rated for the application, and mounted in minimum Nema 1 enclosure.

3. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:

4. Poles – relays having a single pole or single-throw type shall not be used. Relays shall be double-throw type with a minimum of two poles.

5. Relays shall incorporate an led that indicates when the relay coil is energized.

6. Ac coil pull-in voltage range of +10%, -15% or nominal voltage.

7. Coil – sealed, with required volt amperes (va) not greater than four (4) va.

8. Silver cadmium form c (SPDT) contacts in a dust-proof enclosure, with 8 or 11 pin or spade type plug.

9. Pilot light indication of power-to-coil shall be provided for relays installed remotely from the controlling device.

10. Relays shall be Allen Bradley - model 700hk, Idec RH-series or approved equal.

11. Relays used for remote start/stop control of motors and shall have a current rating at least 1.5 times full load amps of the load it is controlling. In addition to the relays specified above, the functional devices ribu1c is also permitted for use here.

12. Relays used for stop/start control shall have low voltage coils (30 vac or less), and shall be provided with transient and surge suppression devices at the controller interface.

13. Control transformers: furnish and install control transformers as required. Control transformers shall be machine tool type, and shall be us and CSA listed. Primary and secondary sides shall be fused in accordance with the NEC. Transformer shall be proper size for application, and mounted in minimum Nema 1 enclosure. Each controller device requiring a low voltage power supply to operate shall be provided with a dedicated transformer.

14. Westinghouse, Square "D", Jefferson or approved equal shall manufacture transformers.

15. Electric push button switch: switch shall be momentary contact, oil tight, push button, with number of N.O. and/or N.C. contacts as required. Contacts shall be snap-action type, and rated for minimum 120 vac operation. Switch shall be 800t type, as manufactured by Allen Bradley or approved equal.

16. Pilot light: panel-mounted pilot light shall be oil tight, transformer type, with screw terminals, led type, rated for 24 vac or 120 vac. Unit shall be as manufactured by Allen Bradley or approved equal.

17. Network connection tool

18. Network connection tool shall allow technician to connect a laptop to any ms/tp network or at any ms/tp device and view and modify all information throughout

the entire BACnet network. Laptop connection to tool shall be via Ethernet or PTP.

19. Provide quick connect to ms/tp Lan at each controller. Tool shall be able to adjust to all ms/tp baud rates specified in the BACnet standard.

2.5 ELECTRONIC ACTUATORS AND VALVES

A. Quality Assurance for Actuators and Valves
   1. UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
   2. Refer to Section GENERAL REQUIREMENTS FOR HVAC WORK for system pressure temperature requirements.
   3. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
   4. Five-year manufacturer's warranty. Two-year unconditional and three-year product defect from date of installation.
      a. Execution Details for Actuators and Valves
   5. Furnish a Freeze-stat and install "Hard Wire" interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
   6. Each DDC analog output point shall have an actuator feedback signal, independent of control signal, wired and terminated in the control panel for true position information and troubleshooting. Or the actuator feedback signal may be wired to the DDC as an analog input for true actuator position status.
   7. Booster-heat valve actuation shall be Floating type or Analog (2-10vdc, 4-20ma).
   8. Primary valve control shall be Analog (2-10vdc, 4-20ma).

B. Actuators for Damper and Control Valves ½" to 6" shall be Electric unless otherwise specified, provide actuators as follows:

1. UL Listed Standard 873 and Canadian Standards association Class 481302 shall certify Actuators.
2. NEMA 2 rated actuator enclosures are. Use additional weather shield to protect actuator when mounted outside.
3. 5 year Manufacturers Warranty. Two-year unconditional + Three year product defect from date of installation.
4. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
5. Position indicator device shall be installed and made visible to the exposed side of the Actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the Actuator.
6. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical

and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for Butterfly Valve actuators.

7. A push button gearbox release shall be provided for all non-spring actuators.
8. Modulating actuators shall be 24Vac and consume 10VA power or less.
9. Conduit connectors are required when specified and when code requires it.

C. Damper Actuators:

1. Outside Air and Exhaust Air Damper Actuators shall be Mechanical Spring Return. Capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
2. Economizer Actuators shall utilize Analog control 2-10 VDC, Floating control is not acceptable.
3. Electric damper actuators (including VAV box actuators) shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
4. One electronic actuator shall be direct shaft mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
5. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section. (See below execution section for more installation details.)

D. Valve Actuators ½" to 6"

1. Mechanical spring shall be provided on all actuators for pre-heat coil and actuators for AHU heating or cooling coil when units are mounted outside. See plans for fail save flow function: Normal Open or Normal Closed. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
2. All zone service actuators shall be non-spring return unless otherwise specified.
3. The valve actuator shall be capable of providing the minimum torque required for proper valve close off for the required application.
4. All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.
5. Override handle and gearbox release shall be provided for all non-spring return valve actuators.

E. Control Dampers.

1. All dampers used for modulating service shall be opposed blade type arrange for normally open or normally closed operation as required. The damper is to be sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.
2. All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.
3. Damper linkage hardware shall be constructed of aluminum or corrosion resistant zinc & nickel-plated steel and furnished as follows:
4. Bearing support bracket and drive blade pin extension shall be provided for each damper section. Sheet metal contractor shall install bearing support bracket and drive
5. blade pin extension. Sheet metal contractor shall provide permanent indication of blade position by scratching or marking the visible end of the drive blade pin extension.
6. Drive pin may be round only if V-bolt and toothed V-clamp is used to cause a cold weld effect for positive gripping. For Single bolt or set-screw type actuator fasteners, round damper pin shafts must be milled with at least one side flat to avoid slippage.
7. Damper manufacturer shall supply alignment plates for all multi-section dampers.

F. Control Valves ½" to 6":

1. The BMS contractor shall furnish all specified motorized control valves and actuators. BMS contractor shall furnish all control wiring to actuators. The Plumbing contractor shall install all valves. Equal Percentage control characteristic shall be provided for all water coil control valves. Linear valve characteristic is acceptable for 3-way valves 2½ inches and above. Johnson Controls or Belimo as standard.
2. Characterized Control Valves shall be used for hydronic heating or cooling applications and small to medium AHU water coil applications to 100GPM. Actuators are non-spring return for terminal unit coil control unless otherwise noted. If the coil is exposed to the Outside Air stream then see plans for Spring Return requirement.
3. Leakage is Zero percent, Close-off is 200psi, and Maximum differential is 30psi. Rangeablity is 500:1.
4. Valves 1/2 inch through 2 inches shall be nickel-plated forged brass body, NPT screw type connections.
5. Valves 1/2 inch through 1-1/4 inches shall be rated for ANSI Class 600 working pressure. Valves 1-1/2 inch and 2 inches shall be rated for ANSI Class 400 working pressure.
6. The operating temperature range shall be 0° to 250° F.
7. Stainless steel ball & stem shall be furnished on all modulating valves.
8. Seats shall be fiberglass reinforced Teflon.
9. Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.
10. Three-way valve shall be applicable for both mixing and diverting.
11. The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.
12. The valves shall have a blow out proof stem design.

13. The stem packing shall consist of 2 lubricated O-rings designed for on-off or modulating service and require no maintenance.
14. The valves shall have an ISO type, 4-bolt flange, for mounting actuator in any orientation parallel or perpendicular to the pipe.
15. A non-metallic thermal isolation adapter shall separate valve flange from actuator.
16. One fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the stem and its packing O-rings.
17. Globe valves ½" to 2" shall be used for steam control or water flow applications.
18. Valves shall be bronze body, NPT screw type, and shall be rated per job pressure/temperature requirements.
19. Valves 1/2 inch (DN15) through 2 inches (DN50) with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (.1%).
20. The operating temperature range shall be 20° to 280° F.
21. Spring loaded TFE packing shall protect against leakage at the stem.
22. Two-way valves shall have an equal percentage control port.
23. Three-way valves shall a linear control and bypass port.
24. Mixing and diverting valves must be installed specific to the valve design.

G. Globe Valve 2 ½ to 6"

1. Valves 2-1/2 inch (DN65) through 6 inches (DN50) shall be iron body, 125 lb. flanged with Class III (.1%) close-off leakage at 50 psi differential.

2. Valves with spring return actuators shall close off against 50 psi pressure differential with Class III leakage (.1%).

3. Flow type for two-way valves shall be equal percentage. Flow type for three-way valves shall be linear.

4. Mixing and diverting valves must be installed specific to the valve design.

5. Butterfly valves

   Butterfly Valves shall be sized for modulating service at 60-70 degree stem rotation. Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats.

   a. Body is Cast Iron.

   b. Disc is Aluminum Bronze standard.

   c. Seat is EPDM Standard.

   d. Body Pressure is 200 psi, -30F to 275F.

   e. Flange is ANSI 125/250.

f. Media Temperature Range is –22F to 240F.

g. Maximum Differential Pressure is 200 psi for 2" to 6" size.

H. Actuators

1. Actuators shall be approved under Canadian Standards Association or other Nationally Recognized Testing Laboratory to UL standards. CSA Class 4813 02 or equal. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.

2. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1 pH, 60 Hz supply. Two adjustable cam actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.

3. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.

4. Actuator shall have a 6 ft wiring harness provided for ease in field wiring (above 1500 in-lbs). Two adjustable SPDT cam-actuated auxiliary switches, rated at 250 VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.

5. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.

6. The actuator shall be Analog, floating, or two position as called out in the control sequence of operation. All Analog valves shall be positive positioning, and respond to a 2-10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.

a.. Performance Verification Test

1. Control loops shall cause productive actuation with each movement of the actuator and actuators shall modulate at a rate which is stable and responsive. Actuator movement shall not occur before the effects of previous movement have affected the sensor.

2. Actuator shall have capability of signaling a trouble alarm when the actuator Stop-Go Ratio exceeds 30%.

7. Actuator Mounting for Damper and Valve arrangements shall comply with the following:

a. Damper Actuators: Shall not be installed in the air stream

b. A weather shield shall be used if actuators are located outside. For Damper Actuators use clear plastic enclosure.

c. Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary

d. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.

e. Damper mounting arrangements shall comply with the following:

1. The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
2. No jack shafting of damper sections shall be allowed.
3. Multi-section dampers shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per section.

f. Size damper sections based on actuator manufacturers specific recommendations for face velocity, differential pressure and damper type. In general:

1. Damper section shall not exceed 24 ft-sq. with face velocity 1500 FPM.
2. Damper section shall not exceed 18 ft-sq. with face velocity 2500 FPM.
3. Damper section shall not exceed 13 ft-sq. with face velocity 3000 FPM.

g. Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.

h. Multiple section dampers of three or more sections wide shall be arranged with a 3-sided vertical channel (8'' wide by 6" deep) within the duct or fan housing and between adjacent damper sections. Vertical channel shall be anchored at the top and bottom to the fan housing or building structure for support. The sides of each damper frame shall be connected to the channels. Holes in the channel shall allow damper drive blade shafts to pass through channel for direct shaft mounting of actuators. Open side of channel shall be faced down stream of the airflow, except for exhaust air dampers.

i. Multiple section dampers to be mounted flush within a wall or housing opening shall receive either vertical channel supports as descried above or sheet metal standout collars. Sheet metal collars (12" minimum) shall bring each damper section out of the wall to allow direct shaft mounting of the actuator on the side of the collar.

I. Valve Sizing for Water Coil

J. On/Off Control Valves shall be line size.

K. Modulating Control Valve Body Size may be reduced at most two pipe sizes from the line size or not less than ½ the pipe size. The BMS contractor shall size all water coil control valves for the application as follows:

1. Booster-heat valves shall be sized not to exceed 4-9psi differential pressure. Size valve for 50% Valve Authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
2. Primary valves shall be sized not to exceed 5-15psi differential pressure. Size valve for 50% Valve Authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
3. Butterfly valves shall be sized for modulating service at 60-70 degree rotation. Design velocity shall be 12 feet per second or less when used with standard EPDM seats.

L. Valve Mounting arrangements shall comply with the following:

1. Unions shall be provided on all ports of two-way and three-way valves.
2. Install three-way equal percentage Characterized Control valves in a mixing configuration with the "A" port piped to the coil.
3. Install 2½ inch and above, Three-Way globe valves, as manufactured for mixing or diverting service to the coil.

2.6 ENCLOSURES

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.

C. Enclosures shall have hinged, locking doors.

D. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.

3.0 EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Commissioner in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

C Operator's terminal

1. The BMS contractor shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:
   a. Personal laptop computer
   b. 512 MB RAM (minimum) – windows 2000 or XP.
   c. SVGA 1024x768 resolution color display
   d. Complete workstation software packages, including any hardware or software.
   e. Software registration cards for all included software shall be provided to the City of New York.
   f. External power supply/battery charger

2. Software
   a. Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
   b. When used to access first or second tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
   c. When used to access application specific controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

3.3 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from Commissioner prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags for all panels.

D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections—sized to suit pipe diameter without restricting flow.

3.4 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state and local electrical codes.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

C. Control wiring shall not be installed in power circuit raceways. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Commissioner prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings—coordinate with electrical contractor. Power circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes. DDC terminal unit controllers may use AC power from motor power circuits. Power shall be derived from emergency power panels for any controls that are connected to life/safety systems.

F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit). Where conduit is required, it shall be steel electric metallic tubing (EMT), except that it shall be galvanized intermediate steel conduit where located within 8'-0" of the floor in mechanical spaces (or is otherwise exposed to mechanical damage), is located outdoors, or is intended for embodiment in concrete.

G. Surge transient protection shall be incorporated in the design of system to protect electrical components in all DDC control panels.

H. All systems requiring interconnecting control wiring as specified herein for all mechanical systems including but not limited to the fuel oil system, emergency generators, chillers, water treatment, AC units, condensing units, PIMs, cooling towers, expansion tanks, VFDs, unit heaters, filtration systems (air and water), terminal units, fan coil units, electric heaters, house tanks, chiller control system, kitchen equipment, fans, H&V, cabinet heaters, hot water heater, ejectors, sump pits, domestic water system, steam PRV stations, underground pipe leak detection system, and plumbing systems.

3.5 DDC OBJECT TYPE SUMMARY

A. Provide all database generation.

B. Displays

1. System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the City of New York. Provide

outside air temperature indication on all system displays associated with economizer cycles.

C. Run Time Totalization

1. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

D. Trend Log

1. All binary and analog object types (including zones) shall have the capability to be automatically trended.

E. Alarm

1. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per City of New York's requirements.

F. Database Save

1. Provide back-up database for all stand-alone application controllers on disk.

3.6 FIELD SERVICES

A. Prepare and start logic control system under provisions of this section.

B. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

C. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. City of New York shall provide phone line for this service for 1 year or as specified.

D. Provide Commissioner with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.7 INSTRUCTION

A. Provide application engineer to instruct an appropriate representative of The City of New York in operation of systems and equipment.

B. Provide system operator's instruction to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data,

execution of commands and request of logs. Provide this instruction to a minimum of 3 persons.

C. Provide on-site instruction above as required, up to 16 hours as part of this contract.

D. Demonstrate complete operating system to Commissioner.

E. Provide certificate stating that control system has been tested and adjusted for proper operation.

END OF SECTION 230900

SECTION 230993

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. HVAC Drawings include operational profiles and relationship diagrams which should be used in conjunction with the requirements of this specification to create control hierarchy and relationship systems.

1.2 SUMMARY

A. This Section includes the basic requirements and point types to support control sequences for HVAC systems, subsystems, and equipment, where the sequences may be found primarily on drawings:
   1. Miscellaneous Fans
   2. Electric Duct Heaters
   3. Water to Water Heat Pump Units
   4. Fan Coil Units
   5. Fin Tube Radiators
   6. Radiant floor hydronic systems
   7. Energy Recovery Ventilators
   8. Pumps
   9. Unit Heaters
   10. Manufacturer Control Packaged Boilers

B. Related Sections include the following:

   1. Section 230900 "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. VAV: Variable air volume.

C. DTS: Dual temperature system

D. FCU: Fan Coil Unit

E. FTR: Fin Tube Radiator

F. Source Water: Dewatering source water from outside bounds of project, used for radiant free cooling and as water-water heat pump source.

1.4 HYDRONIC HEATING AND COOLING CONTROL SEQUENCES

DTS provides heating and cooling. Common elements for heating and cooling are described.

A. Water Supply Temperature Control:

1. Input Device: Thermistor temperature sensor.
2. Output Device: Control valve/boiler mode/heat pump mode
3. Action: Modulate control valve to maintain heating-water supply temperature.
4. Display:

    a. Heating-water supply temperature.
    b. Heating-water supply temperature set point.
    c. Control-valve position.

B. Water Supply Temperature Reset (heating):

1. Input Device: Outdoor-air sensor.
2. Output Device: DDC system software.
3. Action: Reset heating-water supply temperature in straight-line relationship with outdoor-air temperature for the following conditions:

    a. 140 deg F heating water when outdoor-air temperature is 14 deg F or lower.

    b. 90 deg F heating water when outdoor-air temperature is 55 deg F .

    Generation of heating water switches from water source heat pump to boiler based on sump water temperature. When sump water temperature is too low for the water source heat pump, boilers shall be engaged. See M-800 for relationship.

4. Display:

    a. Outdoor-air temperature.
    b. Heating-water supply temperature.
    c. Heating-water supply temperature set point.

C. Control Primary Circulating Pump(s):

1. Input Device: DDC system.
2. Output Device: DDC system command to starter relay.
3. Action: Energize pump(s) when occupied and not in natural ventilation mode or when equipment calls for heating or cooling.
4. Display:

    a. Outdoor-air temperature.

b. Operating status of primary circulating pump(s).

1.5 Water To Water Heat Pump and Boiler System SEQUENCES

A. Start and Stop P-4, HP-1,2, P-2C/H, B-1,2 depending on mode:

1. Enable P-4, HP-1,2, heat pump circulation pumps: When water is present in Pump One sump:

a. Input Device: Water level sensor/float.
b. Output Device: Hard wired through motor starter; DDC system binary output.
c. Action: Confirm water in Pump One sump.

2. Enable: When space conditions are out of range and building is not in natural ventilation mode OR when outdoor air conditions dictate that the building should be in heating or cooling mode OR when space equipment calls for heating or cooling:

a. Input Device: Space thermostat OR DDC system outdoor-air temperature.
b. Output Device: Hard wired through motor starter; DDC system binary output.
c. Action engage cooling: Confirm outdoor-air temperature is above 78 deg F.
d. Action engage heating: confirm outdoor-air temperature is below 50 deg F.

3. Enable: When demand conditions are met:

a. Input Device: DDC system software demand.
b. Action: Confirm cooling demand from ventilation system(s).

4. Initiate:

a. Input Device: DDC system time schedule.
b. Output Device: Binary output.
c. Action: Enable heating and cooling system sequences.

5. Display:

a. Low-level 'Pump One' sump water alarm.
b. Outdoor-air temperature.
c. Cooling (software) demand indication.
d. Time and time schedule.
e. All pump(s) on-off status.
f. All pump(s) on-off indication.

B. Start and Stop DTS circulation Pump(s):

1. Input Device: Flow switch in heat pump/boiler circuit.
2. Output Device: DDC system command to starter relay.
3. Action: Energize pump(s).
4. Display:

a. Chilled-water flow indication.
b. Chilled-water pump(s) on-off status.
c. Chilled-water pump(s) on-off indication.

C. Start and Stop Heat Pumps

1. Input Device: Flow switch in P-4 circuit, DTS circuit.
2. Output Device: DDC system command to starter relay.
3. Action: stage heat pump(s) on.
4. Display:

a. Sump pump water flow indication.

b. DTS flow indication
c. Heat pump on-off indication.
d. Water supply and return temperature

D. Start and Stop Boilers

1. Input Devices: Reset schedule temperature requirement exceeds heat pump capacity. Flow switch in P-2H circuit.
2. Output Device: DDC system command to starter relay.
3. Action: stage boiler(s) on.
4. Display:

a. DTS flow indication.
b. Boiler on-off indication.
c. Water supply and return temperature
d. Water temperature control-point adjustment.

E. Alarm Heat Pump(s) Start Failure:

1. Input Device: Heat Pump software signal.
2. Output Device: DDC system alarm.
3. Action: Signal alarm.
4. Display: Chiller "failure-to-start" indication.

F. Dual Temperature System Water Level:

1. Input Device: Expansion tank level switch.
2. Output Device: DDC system alarm.
3. Action: Signal alarm.
4. Display: Expansion tank low-level alarm.

G. Dual Temperature System Supply Temperature:

1. Input Device: Temperature sensor in common water supply piping.
2. Output Device: DDC system signal to heat pump control panel. DDC system signal to boiler control panel.

3. Action: Maintain constant leaving dual temperature water temperature (cooling mode) OR reset according to highest heating demand in heating mode

   a. Display: Dual temperature water system supply temperature.

H. Operator Station Display: Indicate the following on operator workstation display terminal:

1. DDC system graphic.
2. DDC system status, on-off.
3. Low-level 'Pump One' sump alarm.
4. Outdoor-air temperature.
5. Cooling (software) demand indication.
6. Time and time schedule.
7. Condenser-water pump(s) (P-4) on-off status.
8. Condenser-water pump(s) (P-4) on-off indication.
9. Condenser-water flow indication.
10. Chilled-water pump(s) on-off status.
11. Chilled-water pump(s) on-off indication.
12. Chilled-water flow indication.
13. Refrigeration machine on-off indication.
14. Dual temperature water supply temperature.
15. Dual temperature return temperature.
16. Dual temperature temperature control-point adjustment.
17. Chiller(s) on-off status.
18. Chiller(s) on-off indication.
19. Chiller "failure-to-start" indication.
20. Expansion tank low-level alarm.
21. Condenser-water sump (return) control-point temperature.
22. Condenser-water sump (return) temperature.
23. Condenser-water control-valve position.
24. Condenser-water supply temperature.
25. 'Pump One' sump temperature low temperature alarm (shutdown P-4, heat pumps).
26. Chilled-water pressure drop through chiller.
27. Entering condenser-water temperature.
28. Leaving condenser-water temperature.
29. Condenser-water pressure drop through chiller.
30. Chiller condenser-water supply and return temperature.
31. Chiller chilled-water supply and return temperature.
32. System capacity in tons.

1.6 AIR-HANDLING-UNIT CONTROL SEQUENCES

A. Start and Stop Supply Fan(s):

1. Enable: Smoke Control (ERV-7 only):

   a. Input Device: Duct-mounted smoke detector, located in return air.
   b. Output Device: Hard wired through motor starter; DDC system alarm.
   c. Action: Allow start if duct is free of products of combustion.

2. Initiate: Occupied Time Schedule:

    a. Input Device: DDC system time schedule.
    b. Output Device: Binary output to motor starter.
    c. Action: Energize fan(s).

3. Initiate: Unoccupied Time Schedule:

    a. Input Device: DDC system demand.
    b. Output Device: Binary output to motor starter.
    c. Action: Energize fan(s).

4. Unoccupied Ventilation:

    a. Input Device: DDC system time schedule and output.
    b. Output Device: DDC system binary output to motor starter.
    c. Action: Cycle fan(s) during unoccupied periods.

5. Display: Supply-fan on-off indication.

B. Supply Fan(s) Variable-Volume Control:

1. Occupied Time Schedule:

    a. Input Device: DDC system time schedule.
    b. Output Device: Binary output.
    c. Action: Enable control.

2. Volume Control:

    a. Input Device: DDC System based on system hierarchy and space thermostat
    b. Output Device: DDC system analog output to motor speed controller. Set variable-speed drive to minimum speed when fan is stopped.
    c. Action: Modulate fan and coil control valve to maintain space set point

3. Display:
    a. Supply-fan airflow rate.
    b. Supply-fan speed.

C. Filters: During occupied periods, when fan is running, differential air-pressure transmitters exist.

1. Occupied Time Schedule:

    a. Input Device: DDC system time schedule.
    b. Output Device: DDC system output.
    c. Action: Enable control.

2. Differential Pressure:

    a. Input Device: Differential-pressure switches.

b. Output Device: DDC system alarm.
c. Action: Signal alarm on low- and high-pressure conditions.

3. Display:

a. Filter air-pressure-drop indication.
b. Filter low-air-pressure set point.
c. Filter high-air-pressure set point.

D. Hydronic Coil:

1. Occupied Time Schedule:

a. Input Device: DDC system time schedule.
b. Output Device: Binary output.
c. Action: Enable control.

2. Supply-Air Temperature:

a. Input Device: Duct-mounted thermostat.
b. Output Device: Normally open modulating control valve.
c. Action: Maintain supply-air temperature set point calculated based on space thermostat, modulating to meet space needs.

3. Unoccupied Time Schedule:

a. Input Device: DDC system time schedule and output.
b. Output Device: DDC system binary output.
c. Action: Enable normal control when fan is cycled on.

4. Display:

a. Fan-discharge air-temperature indication.
b. Fan-discharge air-temperature set point.
c. Heating-coil air-temperature indication.
d. Heating-coil air-temperature set point.
e. Heating-coil pump operation indication.
f. Heating-coil control-valve position.
g. Hot-deck air-temperature indication.
h. Hot-deck air-temperature set point.

E. Coordination of Air-Handling Unit Sequences: Ensure that heating mode, cooling mode, ventilation control dampers and the radiant heating/cooling systems and FCU coils have common inputs and do not overlap in function. All threshold temperatures to be user adjustable.

F. Operator Station Display: Indicate the following on operator workstation display terminal:

1. DDC system graphic.
2. DDC system on-off indication.
3. DDC system occupied/unoccupied mode.

4. Outdoor-air-temperature indication.
5. Supply-fan on-off indication.
6. Supply-fan-discharge static-pressure indication.
7. Supply-fan-discharge static-pressure set point.
8. Supply-fan airflow rate.
9. Supply-fan speed.
10. Return-fan on-off indication.
11. Return-air static-pressure indication.
12. Return-air static-pressure set point.
13. Return-fan airflow rate.
14. Return-fan speed.
15. Building static-pressure indication.
16. Building static-pressure set point.
17. Preheat-coil air-temperature indication.
18. Preheat-coil air-temperature set point.
19. Preheat-coil pump operation indication.
20. Preheat-coil control-valve position.
21. Mixed-air-temperature indication.
22. Mixed-air-temperature set point.
23. Mixed-air damper position.
24. Relative humidity indication.
25. Relative humidity set point.
26. Relative humidity control-valve position.
27. Filter air-pressure-drop indication.
28. Filter low-air-pressure set point.
29. Filter high-air-pressure set point.
30. Fan-discharge air-temperature indication.
31. Fan-discharge air-temperature set point.
32. Heating-coil air-temperature indication.
33. Heating-coil air-temperature set point.
34. Heating-coil pump operation indication.
35. Heating-coil control-valve position.
36. Hot-deck air-temperature indication.
37. Hot-deck air-temperature set point.
38. Cooling-coil air-temperature indication.
39. Cooling-coil air-temperature set point.
40. Cooling-coil control-valve position.
41. Cold-deck air-temperature indication.
42. Cold-deck air-temperature set point.
43. Room temperature indication.
44. Room temperature set point.
45. Multizone damper position.

1.7 TERMINAL UNIT OPERATING SEQUENCE

A. Unit Heater, Electric: Room thermostat cycles fan and sequences stages of heating.

B. Radiant Heating Panel, Hydronic:

1. Room Temperature:

    a. Input Devices: Room thermostat, slab temperature sensors
    b. Output Device: DDC evaluation; see M-800 for duty relationships. Packaged skid pumps, Radiant manifold three-way control valve.
    c. Action: Activate radiant heating/cooling system in appropriate mode and control to space/slab setpoints.

2. Display:

    a. Room temperature indication.
    b. Room temperature set point.
    c. RMB status and all other outputs from RMB.

C. Two-Pipe, Single-Coil, Fan-Coil Unit:

1. Occupied Time Schedule:

    a. Input Device: DDC system time schedule.
    b. Output Device: Binary output.
    c. Action: Start and stop fan and enable control.

2. Room Temperature:

    a. Input Device: Room thermostat in room.
    b. Output Device: Electronic control-valve operator.
    c. Action: Modulate valve to maintain temperature.

3. DDC System Changeover:

    a. Input Device: Thermostat and DDC system.
    b. Output Device: DDC system software.
    c. Action: Reverse control-valve action to switch from heating to cooling.

4. Display:

    a. DDC system graphic.
    b. DDC system on-off indication.
    c. DDC system occupied/unoccupied mode.
    d. Room temperature indication.
    e. Room temperature set point.
    f. Control-valve position.
    g. Supply-water temperature indication.
    h. Fan speed.

D. Unit Ventilator: Room thermostat modulates heating-and-cooling control valves; airstream thermostats modulate outdoor- and return-air dampers as follows:

1. Occupied Time Schedule:

a. Input Device: DDC system time schedule.
b. Output Device: Binary output.
c. Action: Start and stop fan, move outdoor- and return-air dampers to minimum outdoor-air position, and enable outdoor air damper control.

E. Radiators and Convectors, Hydronic:

1. Occupancy:

a. Input Device: Occupancy sensor.
b. Output Device: DDC system binary output.
c. Action: Report occupancy and enable occupied temperature set point.

2. Room Temperature:

a. Input Device: Room thermostat, DDC based on system hierarchy.
b. Output Device: Electronic control-valve operators.
c. Action: Modulate valve to maintain temperature.

1) Occupied Temperature: 68 deg F (24 deg C).
2) Unoccupied Temperature: 60 deg F (18 deg C).

3. Display:

a. Room/area served.
b. Room temperature indication.
c. Room temperature set point.
d. Room temperature set point, occupied.
e. Room temperature set point, occupied standby.
f. Room temperature set point, unoccupied.
g. Control-valve position as percent open.

1.8 VENTILATION SEQUENCES

A. Exhaust Fan: Occupancy sensor cycles fan.

B. Kitchen Exhaust Fan: Occupancy sensor starts fan and energizes makeup air fan.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 232113

HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
   1. Dual-temperature heating and cooling water piping.
   2. Radiant floor water piping.
   3. Ground source "Source water" water piping.

B. Related Sections include the following:

   1. Section 232123 "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.

1.3 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
   1. Dual-Temperature Heating and Cooling Water Piping: 150 psig at 200 deg F.
   2. Radiant Floor Water Piping: 150 psig at 150 deg F.
   3. Ground-source "Source Water" Piping: 150 psig at 150 deg F.
   4. Makeup-Water Piping: 80 psig at 150 deg F.
   5. Condensate-Drain Piping: 150 deg F.
   6. Blowdown-Drain Piping: 200 deg F.
   7. Air-Vent Piping: 200 deg F.
   8. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:
   1. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   2. Air control devices.

3. Chemical treatment.
4. Hydronic specialties.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Field quality-control test reports.

D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Water-Treatment Chemicals: Furnish enough chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

B. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

B. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Anvil International, Inc.
b. S. P. Fittings; a division of Star Pipe Products.
c. Victaulic Company.

3. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
4. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

H. Grooved Mechanical-Joint Fittings and Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Anvil International, Inc.
    b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
    c. National Fittings, Inc.
    d. S. P. Fittings; a division of Star Pipe Products.
    e. Victaulic Company.

3. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
4. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Hart Industries International, Inc.
d. Jomar International Ltd.
e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 150 psig.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.5 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC."

C. Bronze, Calibrated-Orifice, Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump; a division of ITT Industries.
c. Flow Design Inc.
d. Gerand Engineering Co.
e. Griswold Controls.
f. Taco.

3. Body: Bronze, ball or plug type with calibrated orifice or venturi.
4. Ball: Brass or stainless steel.
5. Plug: Resin.
6. Seat: PTFE.
7. End Connections: Threaded or socket.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Armstrong Pumps, Inc.
b. Bell & Gossett Domestic Pump; a division of ITT Industries.
c. Flow Design Inc.
d. Gerand Engineering Co.
e. Griswold Controls.
f. Taco.
g. Tour & Andersson; available through Victaulic Company.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig.
11. Maximum Operating Temperature: 250 deg F.

E. Diaphragm-Operated Safety Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Amtrol, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett Domestic Pump; a division of ITT Industries.
d. Conbraco Industries, Inc.
e. Spence Engineering Company, Inc.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.

5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Steel, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Automatic Flow-Control Valves:

1. Body: Brass or ferrous metal.
2. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
3. Combination Assemblies: Include bonze or brass-alloy ball valve.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
7. Minimum CWP Rating: 175 psig.
8. Maximum Operating Temperature: 200 deg F.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.

7. Maximum Operating Temperature: 240 deg F.

D. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

E. Bladder-Type Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature. Factory test with taps fabricated and supports installed and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

F. Tangential-Type Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

G. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig.
3. Maximum Operating Temperature: Up to 300 deg F.

2.7 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

C. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

D. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

E. Expansion fittings are specified in Section 230516 "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Dual-temperature heating and cooling water piping, radiant floor water piping, and ground-loop heat pump water piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Dual-temperature heating and cooling water piping, radiant floor water piping, and ground-loop heat pump water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
   1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
   2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.

C. Dual-temperature heating and cooling water piping, radiant floor water piping, and ground-loop heat pump water piping, installed belowground and within slabs shall be either of the following:

   1. Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered or brazed joints. Use the fewest possible joints.

3.2 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.

F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.3 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

T. Install expansion loops, expansion joints, anchors, and pipe alignment guides as specified in Section 230516 "Expansion Fittings and Loops for HVAC Piping."

U. Identify piping as specified in Section 230553 "Identification for HVAC Piping and Equipment."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.
10. NPS 10: Maximum span, 20 feet; minimum rod size, 3/4 inch.
11. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
12. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
13. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
14. NPS 18: Maximum span, 28 feet; minimum rod size, 1-1/4 inches.
15. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.

3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

F. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

G. Fiberglass Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

H. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
3. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
4. PVC Nonpressure Piping: Join according to ASTM D 2855.

I. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

J. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

K. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

L. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

3.6 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

D. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

E. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system Project requirements.

3.7 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Section 230519 "Meters and Gages for HVAC Piping."

3.8 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.

6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 232113

This Page Intentionally Left Blank

SECTION 232123

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Separately coupled, base-mounted, double-suction centrifugal pumps.
3. Automatic condensate pump units.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal(s) for each pump.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Crane Pumps & Systems.
4. Flowserve Corporation.
5. Grundfos Pumps Corporation.
6. ITT Corporation; Bell & Gossett.
7. Mepco, LLC.
8. PACO Pumps.
9. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
10. Peerless Pump Company.
11. TACO Incorporated.
12. Thrush Company Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
5. Pump Bearings: Permanently lubricated ball bearings.

D. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Open, dripproof.
    b. Enclosure Materials: Cast iron.
    c. Motor Bearings: Permanently lubricated ball bearings.
    d. Unusual Service Conditions:

        1) Ambient Temperature: 90 deg F.
        2) Altitude: 696 above sea level.
        3) High humidity.

    e. Efficiency: Premium efficient.
    f. NEMA Design: 3.
    g. Service Factor: 1.5.

E. Capacities and Characteristics:
    1. See mechanical schedules

2.2 SEPARATELY COUPLED, BASE-MOUNTED, DOUBLE-SUCTION CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps Inc.
2. Aurora Pump; Division of Pentair Pump Group.
3. Crane Pumps & Systems.
4. Flowserve Corporation.
5. ITT Corporation; Bell & Gossett.
6. Mepco, LLC.
7. PACO Pumps.
8. Patterson Pump Co.; a subsidiary of the Gorman-Rupp Co.
9. Peerless Pump Company.
10. TACO Incorporated.

B. Description: Factory-assembled and -tested, centrifugal, impeller-between-bearings, separately coupled, double-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.

C. Pump Construction:

1. Casing: Vertically split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and

ASME B16.1, Class 250 flanges. Casing supports shall allow removal and replacement of impeller without disconnecting piping.

2. Impeller: ASTM B 584, low zinc silicon bronze; statically and dynamically balanced, and keyed to shaft. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: Solid 416 stainless steel.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket.
5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.

D. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor.

E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

G. Motor: Single speed, secured to mounting frame, with adjustable alignment.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

    a. Enclosure: Totally enclosed, fan cooled.
    b. Enclosure Materials: Cast iron.
    c. Motor Bearings: Grease lubricated.
    d. Unusual Service Conditions:

        1) Ambient Temperature: 90 deg F.
        2) Altitude: 696 ft above sea level.
        3) High humidity.

    e. Efficiency: Premium efficient.
    f. NEMA Design: 3.
    g. Service Factor: 1.5.

H. Capacities and Characteristics:

1. See mechanical schedules.

2.3 AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers: Subject to compliance with requirements provide products by one of the following:

1. Beckett Corporation.
2. Hartell Pumps Div.; Milton Roy Co.
3. Little Giant Pump Co.
4. Mepco, LLC.

B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch- (1800-mm-) minimum, electrical power cord with plug.

C. Capacities and Characteristics:

1. Capacity: 205 gallons per hour at 1' head.
2. Shutoff Head: 10'.
3. Switch on level: 2.5".
4. Switch off level: 1.5".
5. Outlet Size: 1/4" MNPT.
6. Motor Horsepower: 1/150 HP.
7. Electrical Characteristics:

    a. Volts: 115.
    b. Phase: Single.
    c. Hertz: 60.
    d. Full-Load Amperes: 1.1.

2.4 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Angle pattern.
2. 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless-steel permanent strainers.
4. Bronze or stainless-steel straightening vanes.
5. Drain plug.
6. Factory-fabricated support.

B. Triple-Duty Valve:

1. Angle or straight pattern.
2. 175-psig pressure rating, cast-iron body, pump-discharge fitting.
3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4 and HI 2.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

E. Equipment Mounting:

1. Install base-mounted pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration Controls for HVAC."

F. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support weight of in-line pumps.

1. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

3.3 ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.4 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install check, shutoff, and throttling valves on discharge side of pumps.

E. Install suction diffuser and shutoff valve on suction side of pumps.

F. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

G. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

H. Install check valve and gate or ball valve on each condensate pump unit discharge.

I. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

J. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 232123

SECTION 232500

HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following HVAC water-treatment systems:

1. Closed Loop Water Treatment Systems (all)

1.3 DEFINITIONS

A. EEPROM: Electrically erasable, programmable read-only memory.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

C. RO: Reverse osmosis.

D. TDS: Total dissolved solids.

E. UV: Ultraviolet.

1.4 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at the project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including hot-water heating and chilled water, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.

3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

D. Open hydronic systems, including condenser water, shall have the following water qualities:

1. pH: Maintain a value within 8.0 to 9.1.
2. "P" Alkalinity: Maintain a maximum value of 100 ppm.
3. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
5. TDS: Maintain a maximum value of 10 ppm.
6. Ammonia: Maintain a maximum value of 20 ppm.
7. Free "OH" Alkalinity: Maintain a maximum value of 0 ppm
8. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

9. Polymer Testable: Maintain a minimum value within 10 to 40.

E. Passivation for Galvanized Steel: For the first 60 days of operation.

1. pH: Maintain a value within 7 to 8.
2. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.
3. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

1.5 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:

1. Bypass feeders.
2. Water meters.
3. Inhibitor injection timers.
4. pH controllers.
5. TDS controllers.

6. Biocide feeder timers.
7. Chemical solution tanks.
8. Injection pumps.
9. Ozone generators.
10. UV-irradiation units.
11. Chemical test equipment.
12. Chemical material safety data sheets.
13. Water softeners.
14. RO units.
15. Multimedia filters.
16. Self-cleaning strainers.
17. Bag- or cartridge-type filters.
18. Centrifugal separators.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: Power and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

B. Manufacturer Seismic Qualification Certification: Submit certification that water filtration units and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
2. Water Analysis: Illustrate water quality available at Project site.
3. Passivation Confirmation Report: Verify passivation of galvanized-steel surfaces, and confirm this observation in a letter to Commissioner.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sensors, injection pumps, water filtration units, and controllers to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 GUARANTEE SERVICE

A. Scope of Guarantee Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for cooling, chilled-water piping heating, hot-water piping condenser-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial water analysis and HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 CLOSED LOOP WATER TREATMENT SYSTEMS

A. Provide and maintain the quality of water as specified herein this request for water treatment service. The water treatment chemicals shall be dispensed through the use of an automatic water treatment chemical dispensing equipment – by pass and filter feeder - for the closed water system. The chemical feed system shall include, but not necessarily be limited to, the following:

1. Provide a liquid organic inhibitor formulated for closed system chemical treatment engineered to prevent scale formation on heat exchanger surfaces and protect against corrosion of ferrous and non-ferrous metals. The product must contain inhibitors which minimize corrosion of ferrous and non-ferrous metals with corrosion rates not to exceed 0.5 mil per year for ferrous metals and 0.1 mil per year for non-ferrous.

2. Make regular systematic analytical examinations of the circulating heat transfer medium in the recirculating system, to insure that the inhibitor has not been depleted.
3. The recirculating system shall be treated in such a manner as to control the pH value as determined by the chemical manufacturer to provide adequate protection.

B. The water treatment performance tests must be conducted at least monthly on operating equipment. These tests shall only be performed by a fully qualified and fully licensed employee of the Water Treatment Contractor, who is experienced in the field of water treatment and whose sole duty is the performance of such tests. This employee shall be fully qualified, licensed and/or certified in strict accordance with any/all Municipal, Local, State and Federal Laws, Regulations and Codes to transport and dispense water treatment chemicals and perform water treatment performance/diagnostic tests. A copy of the results of these water treatment performance tests shall be posted in the on-site water treatment log book and a copy submitted to the City of NY via either U.S. Mail or via electronic mail (e-Mail) for their review immediately after performing these tests and in no case shall delivery of the test results Property Manager exceed five (5) calendar days

C. The Water Treatment Contractor shall establish and maintain a Water Treatment Log at each location, which documents and records all water treatment performance/diagnostic test(s) by date, time, testing employee and results. The Water Treatment Contractor shall provide specific instructions on how the Water Treatment Contractor's employees will maintain the water treatment logs and how the results of the each water treatment performance/diagnostic test(s) will be documented and analyzed in order to ensure compliance to the specifications as detailed in this request for proposal. These instructions shall cover all water treatment performance/diagnostic test(s) required, proper interpretation of these test(s), and proper chemical feeding methods. The instructions shall describe the types and concentrations of chemical to be fed into the respective water systems as called for by the water test analysis

2.2 STAINLESS-STEEL PIPES AND FITTINGS

A. Stainless-Steel Tubing: Comply with ASTM A 269, Type 316.

B. Stainless-Steel Fittings: Complying with ASTM A 815/A 815M, Type 316, Grade WP-S.

C. Two-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, carbon-filled TFE seats, threaded body design with adjustable stem packing, threaded ends, and 250-psig SWP and 600-psig CWP ratings.

D. Three-Piece, Full-Port, Stainless-Steel Ball Valves: ASTM A 351, Type 316 stainless-steel body; ASTM A 276, Type 316 stainless-steel stem and vented ball, threaded body design with adjustable stem packing, threaded ends, and 150-psig SWP and 600-psig CWP rating.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Refer to Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install water testing equipment on wall near water chemical application equipment.

D. Install interconnecting control wiring for chemical treatment controls and sensors.

E. Mount sensors and injectors in piping circuits.

F. Bypass Feeders: Install in closed hydronic systems, including hot-water heating, chilled water, and equipped with the following:

1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
2. Install water meter in makeup water supply.
3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.
5. Install a swing check on inlet after the isolation valve.

3.3 WATER SOFTENER INSTALLATION

A. Install water softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

B. Install seismic restraints for tanks and floor-mounting accessories and anchor to building structure. Refer to Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

C. Install brine lines and fittings furnished by equipment manufacturer but not factory installed.

D. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

E. Install water-testing sets on wall adjacent to water softeners.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Section 232113 "Hydronic Piping."

D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."

E. Refer to Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.

F. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.

G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

C. Remove and replace malfunctioning units and retest as specified above.

D. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising City of New York of changes necessary to adhere to Part 1 "Performance Requirements" Article for each required characteristic. Sample boiler water at four-week intervals following the testing noted above to show that automatic filtration systems are maintaining water quality within performance requirements specified in this Section.

E. At four-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising City of New York of changes necessary to adhere to Part 1 "Performance Requirements" Article.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Steam System: ASTM D 1066.
3. Acidity and Alkalinity: ASTM D 1067.
4. Iron: ASTM D 1068.
5. Water Hardness: ASTM D 1126.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to DDC General Conditions.

B. Instruction: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION 232500

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Sealants and gaskets.
5. Hangers and supports.
6. DuraSystem Fire Rated Ductwork

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Design Criteria Submittal: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Low emitting materials: Adhesive, sealant, paint and coating products used within the vapor barrier shall comply with VOC limits in Section 01 81 19.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Prerequisite EA 2: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Leakage Test Report for Prerequisite EA 2: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
4. Duct-Cleaning Test Report for Prerequisite IEQ 1: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
5. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
6. Provide a completed VOC submittal form per Section 01 81 13.

C. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, and vibration isolation.

D. Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports .

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

E. Mockups:

1. Before installing duct systems, build mockups representing static-pressure classes in excess of 3-inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

a. Five transverse joints.
b. One access door(s).
c. Two typical branch connections, each with at least one elbow.
d. Two typical flexible duct or flexible-connector connections for each duct and apparatus.
e. One 90-degree turn(s) with turning vanes.
f. One fire damper(s).
g. Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick on sheet metal surface of ducts and fittings exposed to corrosive conditions, and minimum 1 mil thick on opposite surface.
3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 DUCT LINER

A. The duct lining shall have the following minimum R values:

Thickness (in)	R Value (hrft2°F/BTU)
1	4.3
1.5	6.3
2	8.7

The minimum duct lining sound absorption coefficients shall be as follows:

Thickness (in.)	NRC

1	.75
1.5	.90
2	1.00

B. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.
   e. Maximum Thermal Conductivity:

      1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

   a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Aeroflex USA Inc.
   b. Armacell LLC.
   c. Rubatex International, LLC

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Bonded Logic, Inc.
b. Reflectix Inc.

2. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at75 deg F mean temperature when tested according to ASTM C 518.
3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

F. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.

4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.4 2HR FIRE AND IMPACT RATED DUCT PRODUCT DESCRIPTION

A. Prefabricated flanged duct sections with an overall wall thickness of 16.52 mm having the required pcf density and thickness to provide 2-hour fire resistance with a galvanized or stainless liner and galvanized or stainless steel impact resistant barrier determined by the nature of the installed environment.

B. The duct assembly shall be listed to achieve a 2-hour fire resistance rating when tested to ISO 6944. Each duct section shall bear the cULus mark.

C. The duct assembly shall be pressure tested to 8" w.c. positive pressure and 6" w.c. negative pressure.

D. The duct assembly shall provide a minimum transmission loss rating of Hz/dB as follows: 63Hz/21dB; 125/24; 250/29; 500/30; 1000/34; 2000/37; 4000/36; 8000/36.

E. Product is manufactured by DuraSystems Barriers Inc. 199 Courtland Ave. Vaughan, Ontario L4K 4T2 (905)-660-4455, (866)-338-0988. Please Contact Gerry Saieva.

F. DuraDuct GNX - 2 hour cULus Listed Fire Resistance Rating

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size,"

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.

8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099000.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
   a. Systems with a Design Static Pressure of Less than 2" Positive or Negative: Before installing exterior duct insulation, test all supply, return, outdoor air, and exhaust ductwork for air leakage. Conduct the tests per the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. The test pressure must be 25 percent greater than the design duct operating pressure. The total allowable leakage must not exceed 5.0 percent of the total system flow. When partial sections of the duct system are tested, the summation of all sections must not exceed the 5.0 percent total allowable leakage for the system. The test must be witnessed by an independent testing agency.
   b. Systems with a Design Static Pressure of More than 2" Positive or Negative: Before installing exterior duct insulation, test all supply, return, outdoor air, and exhaust ductwork for air leakage. Conduct the tests per the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. The test pressure must be 25 percent greater than the design duct operating pressure. The total allowable leakage must not exceed 1.0 percent of the total system flow. When partial sections of the duct system are tested, the summation of all sections must not exceed the 1.0 percent total allowable leakage for the system. The test must be witnessed by an independent testing agency.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by City of New York, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE –

A. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.

2. Ducts Connected to Variable-Air-Volume Air-Handling Units:

a. Pressure Class: Positive 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.

B. Return Ducts:

1. Ducts Connected to Fan Coil Units, Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.

b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 3-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Type 304, stainless-steel sheet, No. 2D finish.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 3-inch wg.
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Terminal Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 3-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
2. PVC-Coated Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

3. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

4. Aluminum Ducts: Aluminumor galvanized sheet steel coated with zinc chromate.

F. Liner:

1. LEED Prerequisite EA 2 requires that duct insulation R-value comply with ASHRAE/IESNA 90.1 tables titled "Minimum Duct Insulation R-Value, Cooling and Heating Only Supply Ducts and Return Ducts" and "Minimum Duct Insulation R-Value, Combined Heating and Cooling Supply Ducts and Return Ducts." If using liner alone to satisfy thermal requirements, verify that material selected is available in thickness needed to provide thermal performance without jeopardizing other requirements.

2. Flexible elastomeric insulation is available in thicknesses through 1-1/2 inches (38 mm), which comply with NFPA 90A. Some options in subparagraphs below may create a restrictive proprietary specification. Verify availability of performance with manufacturers.

G. The duct lining shall have the following minimum R values:

Thickness (in)	R Value (hrft2°F/BTU)

1	4.3
1.5	6.3
2	8.7

The minimum duct lining sound absorption coefficients shall be as follows:

Thickness (in.)	NRC
1	.75
1.5	.90
2	1.00

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm or Lower:

      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.

   b. Velocity 1000 to 1500 fpm:

      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

   c. Velocity 1500 fpm or Higher:

      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

END OF SECTION 233113

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Manual volume dampers.
   2. Control dampers.
   3. Fire dampers.
   4. Smoke dampers.
   5. Combination fire and smoke dampers.
   6. Flange connectors.
   7. Turning vanes.
   8. Remote damper operators.
   9. Duct-mounted access doors.
   10. Flexible connectors.
   11. Flexible ducts.
   12. Duct accessory hardware.

B. Related Requirements:
   1. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. LEED Submittals:

   1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
   2. Product Data for Prerequisite EA 2: Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

C. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
e. Duct security bars.
f. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise

indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 2 finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. Nailor Industries Inc.
   f. Pottorff.
   g. Ruskin Company.
   h. Trox USA Inc.
   i. Vent Products Company, Inc.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

   a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Low-Leakage, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Air Balance Inc.; a division of Mestek, Inc.
    b. American Warming and Ventilating; a division of Mestek, Inc.
    c. McGill AirFlow LLC.
    d. Nailor Industries Inc.
    e. Pottorff.
    f. Ruskin Company.
    g. Trox USA Inc.
    h. Vent Products Company, Inc.

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:

    a. Hat shaped.
    b. 0.094-inch- thick, galvanized sheet steel.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.

6. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized, roll-formed steel, 0.064 inch thick.

7. Blade Axles: Galvanized steel.
8. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

9. Blade Seals: Neoprene.
10. Jamb Seals: Cambered stainless steel.
11. Tie Bars and Brackets: Galvanized steel.
12. Accessories:

a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Lloyd Industries, Inc.
6. McGill AirFlow LLC.
7. Metal Form Manufacturing, Inc.
8. Nailor Industries Inc.
9. NCA Manufacturing, Inc.
10. Pottorff.
11. Ruskin Company.
12. Vent Products Company, Inc.
13. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. 0.094-inch- thick, galvanized sheet steel.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin or 0.0747-inch- thick dual skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Oil-impregnated bronze.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Nailor Industries Inc.
6. NCA Manufacturing, Inc.
7. Pottorff.
8. Prefco; Perfect Air Control, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

K. Heat-Responsive Device: Electric, resettable link and switch package, factory installed, 165 deg F rated.

2.6 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel.

F. Leakage: Class II. Not to exceed 10 CFM per square feet at 1" WG.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.05-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

I. Damper Motors: Modulating or two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Auxiliary switches for signaling, fan control or position indication.
2. Test and reset switches, remote mounted.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded or mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Resettable, 165 deg F rated, fusible links.

G. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel.

J. Leakage: Class II.

K. Rated pressure and velocity to exceed design airflow conditions.

L. Mounting Sleeve: Factory-installed, 0.05-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

M. Master control panel for use in dynamic smoke-management systems.

N. Damper Motors: Modulating action.

O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

P. Accessories:

1. Auxiliary switches for fan control or position indication.
2. Test and reset switches, remote mounted.

2.8 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.9 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.10 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company.

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Copper.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Stainless steel.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. McGill AirFlow LLC.
8. Nailor Industries Inc.
9. Pottorff.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Continuous and two sash locks.

c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.

5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

I. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.14 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.

E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.

F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Pressure Rating: 8-inch wg positive or negative.
2. Maximum Air Velocity: 5000 fpm.
3. Temperature Range: Minus 100 to plus 435 deg F.

G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

H. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

J. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

K. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 8-inch wg positive or negative.
2. Maximum Air Velocity: 5000 fpm.
3. Temperature Range: Minus 20 to plus 250 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

L. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.15 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct security bars. Construct duct security bars from 0.164-inchsteel sleeve, continuously welded at all joints and 1/2-inch- diameter steel bars, 6 inches o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch hinged access panel with cam lock in duct in each side of sleeve.

I. Connect ducts to duct silencers rigidly.

J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

K. Install access doors with swing against duct static pressure.

L. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

M. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

N. Install flexible connectors to connect ducts to equipment.

O. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

P. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

Q. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

R. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

S. Install duct test holes where required for testing and balancing purposes.

T. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233416

CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes: For each product.

1. Airfoil centrifugal fans.
2. Backward-inclined centrifugal fans.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Motor ratings and electrical characteristics, plus motor and electrical accessories.
5. Material thickness and finishes, including color charts.
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
2. Operating Limits: Classify according to AMCA 99.

B. Unusual Service Conditions:

1. Ambient Temperature: 86 deg F.
2. Altitude: 639 feet above sea level.
3. High humidity.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Capacities and Characteristics:

1. Total Airflow: refer to mechanical schedules.
2. External Static Pressure: refer to mechanical schedules.
3. Class: refer to mechanical schedules.
4. Arrangement: refer to mechanical schedules.
5. Housing Material: Reinforced steel.
6. Special Housing Coating: Hot-dip galvanized;.
7. Wheel Size (Diameter): refer to mechanical schedules.
8. Wheel Material: Steel.
9. Special Wheel Coating: Hot-dip galvanized;.

10. Brake Horsepower: refer to mechanical schedules.
11. Drive Type: refer to mechanical schedules.
12. Fan Rpm: refer to mechanical schedules.
13. Outlet Velocity: refer to mechanical schedules.
14. Motor:

    a. Motor Enclosure: Totally enclosed, air over.
    b. Enclosure Materials: Cast iron.
    c. Efficiency: Premium efficient.
    d. NEMA Design: 4.
    e. Service Factor: refer to mechanical schedules.
    f. Electrical Characteristics:

        1) Motor Size: refer to mechanical schedules.
        2) Motor Rpm: refer to mechanical schedules.
        3) Volts: refer to mechanical schedules.
        4) Phase: refer to mechanical schedules.
        5) Hertz: 60.
        6) Full-Load Amperes: refer to mechanical schedules.
        7) Minimum Circuit Ampacity: refer to mechanical schedules.
        8) Maximum Overcurrent Protection: refer to mechanical schedules.

15. Discharge Sound Power:

16. refer to mechanical schedules

17. Vibration Isolators: Spring isolators having a static deflection of 1 inch.
18. Spark-Resistance Class: A.

2.2 AIRFOIL CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Mfg. Corp.
2. Chicago Blower Corporation.
3. Cincinnati Fan.
4. CML Northern Blower Inc.
5. Howden Buffalo Inc.
6. Loren Cook Company.
7. New York Blower Company (The).

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Airfoil Wheels:

1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange.
2. Heavy backplate.
3. Hollow die-formed, airfoil-shaped blades continuously welded at tip flange and backplate.
4. Cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings:

1. Self-aligning, pillow-block-type bearings.
2. Ball-Bearing Rating Life: ABMA 9, Ll0 at 50,000 hours.

G. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, Ll0 at 50,000 hours.

H. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, Ll0 at 50,000 hours.

I. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

J. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 BACKWARD-INCLINED CENTRIFUGAL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan company.
3. Central Blower Company.
4. Chicago Blower Corporation.
5. Cincinnati Fan.
6. CML Northern Blower Inc.
7. Howden Buffalo Inc.
8. Loren Cook Company.
9. New York Blower Company (The).

B. Description:

1. Factory-fabricated, -assembled, -tested, and -finished, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.

2. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations.
3. Factory-installed and -wired disconnect switch.

C. Housings:

1. Formed panels to make curved-scroll housings with shaped cutoff.
2. Panel Bracing: Steel angle- or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing.
4. Spun inlet cone with flange.
5. Outlet flange.

D. Backward-Inclined Wheels:

1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

E. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

F. Prelubricated and Sealed Shaft Bearings:

1. Self-aligning, pillow-block-type ball bearings.
2. Ball-Bearing Rating Life: ABMA 9, Ll0 at 50,000 hours.

G. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, tapered roller bearings with double-locking collars and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, Ll0 at 50,000 hours.

H. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
2. Ball-Bearing Rating Life: ABMA 9, Ll0 at 50,000 hours.

I. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.

4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning.

J. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Scroll Drain Connection: NPS 1 steel pipe coupling welded to low point of fan scroll.
3. Companion Flanges: Rolled flanges for duct connections of same material as housing.
4. Variable Inlet Vanes: With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double-width fans.
5. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens: Grid screen of same material as housing.
7. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
8. Spark-Resistant Construction: AMCA 99.
9. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
10. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.4 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210/ASHRAE 51, "Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Install centrifugal fans on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration Controls for HVAC."

E. Curb Support: Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.

F. Unit Support: Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

G. Isolation Curb Support: Install centrifugal fans on isolation curbs, and install flexible duct connectors and vibration isolation and seismic-control devices.

1. Comply with requirements in Section 233300 "Air Duct Accessories" for flexible duct connectors.
2. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation and seismic-control devices.

H. Install units with clearances for service and maintenance.

I. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
10. Remove and replace malfunctioning units and retest as specified above.

D. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 233416

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 233600

AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Shutoff, single-duct air terminal units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.

1. Air terminal units.
2. Liners and adhesives.
3. Sealants and gaskets.
4. Seismic-restraint devices.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

D. Design Submittal:

1. Materials, fabrication, assembly, and spacing of hangers and supports.

2. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Size and location of initial access modules for acoustic tile.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in DDC General Conditions, include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Powered-Unit Filters: Furnish one spare filter(s) for each filter installed.

1.7 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7 SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems".

1. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Anemostat Products; a Mestek Company.
2. Carnes.
3. Environmental Technologies, Inc.
4. Krueger.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Phoenix Controls Corporation.
8. Price Industries.
9. Titus.
10. Trane; a business of American Standard Companies.
11. Trox USA Inc.; a subsidiary of the TROX GROUP.
12. Tuttle & Bailey.
13. Warren Technology.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.034-inch steel, single wall.

1. Casing Lining: Adhesive attached, 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

    a. Cover liner with nonporous foil.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections, size matching inlet size.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.

E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.

1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Damper Position: Normally open.

F. Attenuator Section: 0.034-inch steel sheet.

1. Lining: Adhesive attached, 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.

   a. Cover liner with nonporous foil.

2. Lining: Adhesive attached, 3/4-inch- thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
1. Nickel chrome 80/20 heating elements.
2. Airflow switch for proof of airflow.
3. Fan interlock contacts.

H. Electronic Controls: Bidirectional damper operator and microprocessor-based thermostat with integral airflow transducer and room sensor. Control devices shall be compatible with temperature controls specified in Section 230900 "Instrumentation and Control for HVAC" and shall have the following features:

1. Damper Actuator: 24 V, powered closed, powered open.
2. Velocity Controller: Factory calibrated and field adjustable to minimum and maximum air volumes; shall maintain constant airflow dictated by thermostat within 5 percent of set point while compensating for inlet static-pressure variations up to 4-inch wg; and shall have a multipoint velocity sensor at air inlet.
3. Thermostat: Wall-mounted electronic type with temperature set-point display in Fahrenheit and Celsius.

I. Direct Digital Controls: Single-package unitary controller and actuator specified in Section 230900 "Instrumentation and Control for HVAC."

1. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

J. Control Sequence:

1. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg inlet static pressure.
2. System-powered, wall-mounted thermostat.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Steel Cables: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

G. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Test assembled air terminal units according to ARI 880.

1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

3.2 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.3 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems." ASCE/SEI 7.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on air terminal units that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service and an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Commissioner if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.4 CONNECTIONS

A. Install piping adjacent to air terminal unit to allow service and maintenance.

B. Hot-Water Piping: In addition to requirements in Section 232113 "Hydronic Piping", connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

C. Connect ducts to air terminal units according to Section 233113 "Metal Ducts."

D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

3.5 IDENTIFICATION

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

D. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Air terminal unit will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.
7. Ceiling-integral continuous diffusers.
8. Light troffer diffusers.
9. Linear floor diffuser plenums.
10. Modular core supply grilles.
11. Continuous tubular diffusers.
12. Adjustable bar registers and grilles.
13. Linear bar grilles.

B. Related Sections:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Round Ceiling Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anemostat Products; a Mestek company.
b. Carnes.
c. Hart & Cooley Inc.
d. METALAIRE, Inc.
e. Nailor Industries Inc.
f. Price Industries.
g. Titus.
h. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Refer to Schedule Sheet.
4. Finish: Refer to Schedule Sheet
5. Face Style: Refer to Schedule Sheet.
6. Mounting: Duct connection.
7. Pattern: Refer to Schedule Sheet
8. Dampers: Refer to Schedule Sheet
9. Accessories:

a. Equalizing grid.
b. Plaster ring.

c. Safety chain.
d. Wire guard.
e. Sectorizing baffles.
f. Operating rod extension.

B. Rectangular and Square Ceiling Diffusers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. Hart & Cooley Inc.
e. Krueger.
f. METALAIRE, Inc.
g. Nailor Industries Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Refer to Schedule Sheet
4. Finish: Refer to Schedule Sheet
5. Face Size: Refer to Schedule Sheet
6. Face Style: Refer to Schedule Sheet
7. Mounting: Refer to Schedule Sheet
8. Pattern: Refer to Schedule Sheet
9. Dampers: Refer to Schedule Sheet
10. Accessories:

a. Equalizing grid.
b. Plaster ring.
c. Safety chain.
d. Wire guard.
e. Sectorizing baffles.
f. Operating rod extension.

C. Perforated Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Research Diffuser Products, Inc.
b. A-J Manufacturing Co., Inc.
c. Anemostat Products; a Mestek company.
d. Carnes.
e. Hart & Cooley Inc.

f. Krueger.
g. METALAIRE, Inc.
h. Nailor Industries Inc.
i. Price Industries.
j. Titus.
k. Tuttle & Bailey.
l. Warren Technology.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Steel backpan and pattern controllers, with steel face.
4. Finish: Refer to Schedule Sheet
5. Face Size: Refer to Schedule Sheet
6. Duct Inlet: Refer to Schedule Sheet
7. Face Style: Refer to Schedule Sheet
8. Mounting: Refer to Schedule Sheet
9. Pattern Controller: Refer to Schedule Sheet
10. Dampers: Refer to Schedule Sheet
11. Accessories:

a. Equalizing grid.
b. Plaster ring.
c. Safety chain.
d. Wire guard.
e. Sectorizing baffles.
f. Operating rod extension.

D. Louver Face Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. A-J Manufacturing Co., Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. METALAIRE, Inc.
e. Nailor Industries Inc.
f. Price Industries.
g. Titus.
h. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Refer to Schedule Sheet
4. Finish: Refer to Schedule Sheet
5. Face Size: Refer to Schedule Sheet
6. Mounting: Refer to Schedule Sheet
7. Pattern: Refer to Schedule Sheet
8. Dampers: Refer to Schedule Sheet
9. Accessories:

a. Square to round neck adaptor.
b. Adjustable pattern vanes.
c. Throw reducing vanes.
d. Equalizing grid.
e. Plaster ring.
f. Safety chain.
g. Wire guard.
h. Sectorizing baffles.
i. Operating rod extension.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Research Diffuser Products, Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Dayus Register & Grille Inc.
    e. Hart & Cooley Inc.
    f. Krueger.
    g. METALAIRE, Inc.
    h. Nailor Industries Inc.
    i. Price Industries.
    j. Titus.
    k. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Refer to Schedule Sheet
4. Finish: Refer to Schedule Sheet
5. Spacing Arrangement: Refer to Schedule Sheet
6. Frame: Refer to Schedule Sheet
7. Mounting Frame: Refer to Schedule Sheet
8. Mounting: Refer to Schedule Sheet
9. Damper Type: Refer to Schedule Sheet
10. Accessories: Refer to Schedule Sheet

B. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Research Diffuser Products, Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.

d. Hart & Cooley Inc.
e. Krueger.
f. METALAIRE, Inc.
g. Nailor Industries Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material - Shell: Refer to Schedule Sheet
4. Material - Pattern Controller and Tees: Refer to Schedule Sheet.
5. Finish - Face and Shell: Refer to Schedule Sheet
6. Finish - Pattern Controller: Refer to Schedule Sheet
7. Finish - Tees: Refer to Schedule Sheet
8. Slot Width: Refer to Schedule Sheet
9. Number of Slots: Refer to Schedule Sheet
10. Length: Refer to Schedule Sheet
11. Accessories: Refer to Schedule Sheet.

C. Ceiling-Integral Continuous Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Research Diffuser Products, Inc.
b. Anemostat Products; a Mestek company.
c. Carnes.
d. Hart & Cooley Inc.
e. Krueger.
f. METALAIRE, Inc.
g. Nailor Industries Inc.
h. Price Industries.
i. Titus.
j. Tuttle & Bailey.

2. Slot Width: TBD
3. Section Length: Refer to Schedule Sheet
4. Straight and curved sections as required to accommodate layout.
5. Mitered tees and corners.
6. Pattern Controllers: Refer to Schedule Sheet
7. Material: Aluminum, extruded, heavy wall.
8. Finishes:

a. Exterior: Standard white.
b. Interior: Standard black.

9. Throw: Refer to Schedule Sheet
10. Mounting: Refer to Schedule Sheet
11. Plenum: Refer to Schedule Sheet

12. Other Features:

    a. Painted interior.
    b. Blank-offs.

D. Light Troffer Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Anemostat Products; a Mestek company.
    b. Carnes.
    c. Hart & Cooley Inc.
    d. Krueger.
    e. METALAIRE, Inc.
    f. Nailor Industries Inc.
    g. Price Industries.
    h. Titus.
    i. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Refer to Schedule Sheet
4. Finish: Refer to Schedule Sheet
5. Slot Width: Refer to Schedule Sheet
6. Number of Sides: Refer to Schedule Sheet
7. Length: Refer to Schedule Sheet
8. Pattern: Refer to Schedule Sheet
9. Inlet: Refer to Schedule Sheet
10. Inlet Size: Refer to Schedule Sheet

2.3 UNDERFLOOR AIR DISTRIBUTION DIFFUSERS

A. Round Induction Diffusers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Research Diffuser Products, Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Hart & Cooley Inc.
    e. Krueger.
    f. METALAIRE, Inc.
    g. Nailor Industries Inc.
    h. Price Industries.
    i. Titus.

2. Airflow Principle: Swirl-pattern induction.
3. Material: Plastic, high impact, and resistant to cart and foot traffic.
4. Color: TBD
5. Components:

    a. Diffuser core.
    b. Flow regulator.
    c. Dirt and liquid catch pan.
    d. Spacer flange.
    e. Gasketed, underfloor compression ring.

B. Linear Floor Diffuser Plenums:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Research Diffuser Products, Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Hart & Cooley Inc.
    e. Krueger.
    f. METALAIRE, Inc.
    g. Nailor Industries Inc.
    h. Price Industries.
    i. Titus.

2. Material: Steel.
3. Finish: White baked acrylic.
4. Deflection: Refer to Schedule Sheet
5. Components:

    a. Aluminum diffuser core.
    b. Diffuser frame.
    c. Plenum, 0.034-inch steel.

2.4 FLEXIBLE DIFFUSION OUTLETS

A. Continuous Tubular Diffuser:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Air Distribution Concepts.
    b. Airmax International.
    c. DuctSox Corp.
    d. Fabric Duct Systems.
    e. FabricAir Inc.

2. Material: TBD
3. Duct Connection: Round.
4. Duct Connection Size: Refer to Schedule Sheet
5. Diffusion Hole Size: Refer to Schedule Sheet
6. Diffusion Hole Frequency - Number per 100 Feet: Refer to Schedule Sheet
7. Accessories:

    a. Quick-connect joint.
    b. Snap hooks.
    c. Cleanout zipper.
    d. Condensate drain.

2.5 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. A-J Manufacturing Co., Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Dayus Register & Grille Inc.
    e. Hart & Cooley Inc.
    f. Krueger.
    g. METALAIRE, Inc.
    h. Nailor Industries Inc.
    i. Price Industries.
    j. Titus.
    k. Tuttle & Bailey.

2. Material: Refer to Schedule Sheet
3. Finish: Refer to Schedule Sheet
4. Face Blade Arrangement: Refer to Schedule Sheet
5. Core Construction: Refer to Schedule Sheet
6. Rear-Blade Arrangement: Refer to Schedule Sheet
7. Frame: Refer to Schedule Sheet.
8. Mounting Frame: Refer to Schedule Sheet
9. Mounting: Refer to Schedule Sheet
10. Damper Type: Refer to Schedule Sheet
11. Accessories:

    a. Refer to Schedule Sheet

B. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. A-J Manufacturing Co., Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Dayus Register & Grille Inc.
    e. Hart & Cooley Inc.
    f. Krueger.
    g. METALAIRE, Inc.
    h. Nailor Industries Inc.
    i. Price Industries.
    j. Titus.
    k. Tuttle & Bailey.

2. Material: Refer to Schedule Sheet
3. Finish: Refer to Schedule Sheet
4. Face Blade Arrangement: Refer to Schedule Sheet
5. Core Construction: Refer to Schedule Sheet
6. Rear-Blade Arrangement: Refer to Schedule Sheet
7. Frame: Refer to Schedule Sheet
8. Mounting Frame: Refer to Schedule Sheet
9. Mounting: Refer to Schedule Sheet

C. Linear Bar Grille:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. A-J Manufacturing Co., Inc.
    b. Anemostat Products; a Mestek company.
    c. Carnes.
    d. Dayus Register & Grille Inc.
    e. Hart & Cooley Inc.
    f. Krueger.
    g. Nailor Industries Inc.
    h. Price Industries.
    i. Titus.
    j. Tuttle & Bailey.

2. Material: Refer to Schedule Sheet
3. Finish: Refer to Schedule Sheet
4. Face Arrangement: Refer to Schedule Sheet
5. Distribution plenum.

    a. Internal insulation.
    b. Inlet damper.

6. Frame: TBD.
7. Mounting Frame: Refer to Schedule Sheet
8. Mounting: Refer to Schedule Sheet
9. Damper Type: Refer to Schedule Sheet

2.6 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Commissioner for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

This Page Intentionally Left Blank

SECTION 234100

PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. For filters associated with Air Handling Units and Fan Coil Units and other devices in the project specifications, refer to that particular section.

1.2 SUMMARY

A. Section Includes:

1. Metal panel filters.
2. Flat panel filters.
3. Pleated panel filters.
4. V-bank cell filters.
5. Front- and rear-access filter frames.
6. Side-service housings.
7. Filter gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content.
3. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For air filters. Include plans, elevations, sections, details, and attachments to other work.

1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
3. Wiring Diagrams: For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.
2. Provide one container(s) of red oil for inclined manometer filter gage.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
2. Comply with ASHRAE 52.1 for arrestance and ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

C. Comply with NFPA 90A and NFPA 90B.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All outdoor intakes shall have MERV 13 filters. Fans shall be sized with static to suit and meet design criteria through associate filters.

B. Comply with all LEED requirements for filtration throughout.

2.2 METAL PANEL FILTERS

A. Description: Factory-fabricated, self-supported, cleanable, all-metal, impingement-type, panel-type, permanent air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AAF International.
b. Airguard.
c. Camfil Farr.
d. Filtration Group.
e. Flanders-Precisionaire.
f. Koch Filter Corporation.
g. Purafil, Inc.
h. Research Products Corp.

B. Media: Six alternate layers of galvanized-steel flat and herringbone-crimp screen.

1. Nonoiled for grease removal application.
2. Adhesive coating.

a. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Filter-Media Frame: Galvanized steel, hinged, and with pull and retaining handles fastened to the media.

1. Drain holes.

D. Capacities and Characteristics:
1. Refer to mechanical drawings.

2.3 FLAT PANEL FILTERS

A. Description: Factory-fabricated, self-supported, flat, nonpleated, panel-type, disposable air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. AAF International.
   b. Airguard.
   c. Camfil Farr.
   d. Columbus Industries, Inc.
   e. CRS Industries, Inc.; CosaTron Division.
   f. D-Mark.
   g. Filtration Group.
   h. Flanders-Precisionaire.
   i. Koch Filter Corporation.
   j. Purafil, Inc.
   k. Research Products Corp.
   l. Tri-Dim Filter Corporation.

B. Filter Unit Class: UL 900, Class 2.

C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Media shall be coated with an antimicrobial agent.
4. Metal Retainer: Upstream side and downstream side.

D. Filter-Media Frame: Galvanized steel with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics:
1. Refer to mechanical drawings.

2.4 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. AAF International.
    b. Airguard.
    c. Camfil Farr.
    d. Columbus Industries, Inc.
    e. CRS Industries, Inc.; CosaTron Division.
    f. D-Mark.
    g. Filtration Group.
    h. Flanders-Precisionaire.
    i. Koch Filter Corporation.
    j. Purafil, Inc.
    k. Research Products Corp.
    l. Tri-Dim Filter Corporation.

B. Filter Unit Class: UL 900, Class 2.

C. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Media shall be coated with an antimicrobial agent.
4. Separators shall be bonded to the media to maintain pleat configuration.
5. Welded wire grid shall be on downstream side to maintain pleat.
6. Media shall be bonded to frame to prevent air bypass.
7. Support members on upstream and downstream sides to maintain pleat spacing.

D. Filter-Media Frame: Galvanized steel with metal grid on outlet side and steel rod grid on inlet side, hinged, with pull and retaining handles sealed or bonded to the media.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics:
1. Refer to mechanical drawings.

2.5 V-BANK CELL FILTERS

A. Description: Factory-fabricated, adhesive-coated, disposable, packaged air filters with media angled to airflow, and with holding frames.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AAF International.
b. Airguard.
c. Camfil Farr.
d. Columbus Industries, Inc.
e. CRS Industries, Inc.; CosaTron Division.
f. D-Mark.
g. Filtration Group.
h. Flanders-Precisionaire.
i. Koch Filter Corporation.
j. Purafil, Inc.
k. Research Products Corp.
l. Tri-Dim Filter Corporation.

B. Filter Unit Class: UL 900, Class 2.

C. Media: Fibrous material constructed so individual pleats are maintained in tapered form under rated-airflow conditions by flexible internal supports.

1. Adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Media shall be coated with an antimicrobial agent.

D. Filter-Media Frames: Galvanized steel.

E. Mounting Frames: Welded galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

F. Capacities and Characteristics:
1. Refer to mechanical drawings.

2.6 FRONT- AND REAR-ACCESS FILTER FRAMES

A. Framing System: Galvanized-steel framing members with access for either upstream (front) or downstream (rear) filter servicing, cut to size and prepunched for assembly into modules. Vertically support filters to prevent deflection of horizontal members without interfering with either filter installation or operation.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AAF International.
b. Airguard.
c. Camfil Farr.
d. Columbus Industries, Inc.
e. CRS Industries, Inc.; CosaTron Division.
f. D-Mark.

g. Filtration Group.
h. Flanders-Precisionaire.
i. Koch Filter Corporation.
j. Purafil, Inc.
k. Research Products Corp.

B. Prefilters: Incorporate a separate track with spring clips, removable from front or back.

C. Sealing: Factory-installed, positive-sealing device for each row of filters, to ensure seal between gasketed filter elements and to prevent bypass of unfiltered air.

2.7 SIDE-SERVICE HOUSINGS

A. Description: Factory-assembled, side-service housings, constructed of galvanized steel with flanges to connect to duct or casing system.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AAF International.
b. Airguard.
c. Camfil Farr.
d. Columbus Industries, Inc.
e. CRS Industries, Inc.; CosaTron Division.
f. D-Mark.
g. Filtration Group.
h. Flanders-Precisionaire.
i. Koch Filter Corporation.
j. Purafil, Inc.
k. Research Products Corp.

B. Prefilters: Integral tracks to accommodate 2-inch- deep, disposable or washable filters.

C. Access Doors: Hinged, with continuous gaskets on perimeter and positive-locking devices, and arranged so filter cartridges can be loaded from either access door.

D. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames and to prevent bypass of unfiltered air.

2.8 FILTER GAGES

A. Diaphragm-type gage with dial and pointer in metal case, vent valves, black figures on white background, and front recalibration adjustment.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Airguard.
b. Dwyer Instruments, Inc.

2. Diameter: 2 inches.
3. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5-Inch wg or Less: 0- to 0.5-inch wg.
4. Scale Range for Filter Media Having a Recommended Final Resistance of 0.5- to 1.0-Inch wg or Less: 0- to 1.0-inch wg.
5. Scale Range for Filter Media Having a Recommended Final Resistance of 1.0- to 2.0-Inch wg or Less: 0- to 2.0-inch wg.
6. Scale Range for Filter Media Having a Recommended Final Resistance of 2.0- to 3.0-Inch wg or Less: 0- to 3.0-inch wg.
7. Scale Range for Filter Media Having a Recommended Final Resistance of 3.0- to 4.0-Inch wg or Less: 0- to 4.0-inch wg.

B. Manometer-Type Filter Gage: Molded plastic, with epoxy-coated aluminum scale and logarithmic-curve tube gage with integral leveling gage, graduated to read from 0- to 3.0-inch wg, and accurate within 3 percent of the full scale range.

C. Accessories: Static-pressure tips, tubing, gage connections, and mounting bracket.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

B. Install filters in position to prevent passage of unfiltered air.

C. Install filter gage for each filter bank.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

E. Install filter-gage, static-pressure taps upstream and downstream from filters. Install filter gages on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gages on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gages.

F. Coordinate filter installations with duct and air-handling-unit installations.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Operate automatic roll filters to demonstrate compliance with requirements.
2. Test for leakage of unfiltered air while system is operating.

C. Air filter will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 235533

FUEL-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes gas-fired unit heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of fuel-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.

B. Shop Drawings: For fuel-fired unit heaters; signed and sealed by a qualified professional engineer. Include plans, elevations, sections, details, and attachments to other work.

1. Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of fuel-fired unit heaters, as well as procedures and diagrams.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
4. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which equipment will be attached.
2. Items penetrating roof and the following:

a. Vent and gas piping rough-ins and connections.

B. Field quality-control test reports.

C. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired unit heaters to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One for each belt-driven fan size.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GAS-FIRED UNIT HEATERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Lennox Industries, Inc.
2. Modine Manufacturing Company.
3. Reznor/Thomas & Betts Corporation.
4. Sterling HVAC Products; Div. of Mestek Technology Inc.
5. Solaronics.

B. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

C. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

D. Type of Venting: Gravity vented.

E. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.

1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.

F. Heat Exchanger: Stainless steel.

G. Burner Material: Stainless steel.

H. Unit Fan: Formed-steel propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.

1. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
2. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

I. Unit Fan: Steel, centrifugal fan dynamically balanced and resiliently mounted.

1. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

a. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
b. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
c. Pulleys: Cast-iron, adjustable-pitch motor pulley.

2. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

J. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

1. Gas Control Valve: Single stage.
2. Ignition: Electronically controlled electric spark with flame sensor.
3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
4. Vent Flow Verification: Flame rollout switch.
5. High Limit: Thermal switch or fuse to stop burner.
6. Thermostats: No thermostat is required. Provide manually-actuated timer with maximum on-time of 30 minutes.

K. Accessories:
1. Discharge Nozzle: Discharge at 50 to 90 degrees (0.87 to 1.57 radians) from horizontal.
2. Four-point suspension kit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.

B. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb. Install in accordance with all manufacturer's recommendations.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to fuel-fired unit heater to allow service and maintenance.

C. Gas Piping: Comply with all relevant codes and standards. Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with all relevant codes and standards, and manufacturers' recommendations.

E. Electrical Connections: Comply with applicable requirements in electrical Sections.

1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Tests and Inspections:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

a. Test procedures used.
b. Test results that comply with requirements.
c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and service fuel-fired unit heaters. Refer to DDC General Conditions.

END OF SECTION 235533

This Page Intentionally Left Blank

SECTION 235700

HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes plate and frame heat exchangers.

1.3 DEFINITIONS

A. TEMA: Tubular Exchanger Manufacturers Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
2. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

C. Design Submittal: Details and design calculations for seismic restraints for heat exchangers.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Tube-removal space.
2. Structural members to which heat exchangers will be attached.

B. Seismic Qualification Certificates: For heat exchanger, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Heat Exchanger: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of heat exchanger anchorage devices on which certification is based and their installation requirements.

C. Product Certificates: For each type of shell-and-tube heat exchanger. Documentation that shell-and-tube heat exchangers comply with "TEMA Standards."

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including heat exchanger, storage tank, and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Plate, Heat Exchangers:
1) Plate-and-Frame Type: 2 year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Engineering Services: Engage a qualified professional engineer, to design seismic restraints for heat exchangers.

B. Seismic Performance: Heat exchangers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Component Importance Factor is 1.5.

2.2 GASKETED-PLATE HEAT EXCHANGERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Alfa Laval Inc.
2. API Heat Transfer Inc.
3. APV; a brand of SPX Corporation.
4. Armstrong Pumps, Inc.
5. Delta T Heat Exchangers.
6. ITT Corporation; Bell & Gossett.
7. Mueller, Paul, Company.
8. Polaris Plate Heat Exchangers.
9. SEC Heat Exchangers.
10. TACO Incorporated.
11. Thermo Dynamics Ltd.
12. Tranter, Inc.

B. Configuration: Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.

C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

D. Frame:

1. Capacity to accommodate 30 percent additional plates.
2. Painted carbon steel with provisions for anchoring to support.

E. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.

1. Fabricate attachment of heat-exchanger carrying and guide bars with reinforcement strong enough to resist heat-exchanger movement during seismic event when heat-exchanger carrying and guide bars are anchored to building structure.

F. End-Plate Material: Painted carbon steel.

G. Tie Rods and Nuts: Steel or stainless steel.

H. Plate Material: 0.024 inch thick before stamping; Type 304 stainless steel.

I. Gasket Materials: Nitrile rubber.

1. Glue: Chlorine free.

J. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tappings to shell before testing and labeling.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

K. Enclose plates in solid stainless-steel removable shroud.

L. Capacities and Characteristics:
1. Refer to mechanical drawings.

2.3 ACCESSORIES

A. Hangers and Supports:

1. Custom, steel supports for mounting on floor (concrete pad).

2. Factory-fabricated steel supports to ensure both horizontal and vertical support of heat exchanger. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Shroud: Stainless-steel sheet.

C. Pressure Relief Valves: Steel, 2 inch, ASME rated and stamped.

1. Pressure relief valve setting: as per TAB technician report.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect heat exchangers according to ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1. Affix ASME label.

B. Hydrostatically test heat exchangers to minimum of one and one-half times pressure rating before shipment.

C. Heat exchangers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GASKETED-PLATE HEAT-EXCHANGER INSTALLATION

A. Install gasketed-plate heat exchanger on custom-designed wall supports anchored to structure as indicated on Drawings.

B. Install metal shroud over installed gasketed-plate heat exchanger according to manufacturer's written instructions.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Section 232113 "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.

C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

D. Install shutoff valves at heat-exchanger inlet and outlet connections.

E. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

F. Install vacuum breaker at heat-exchanger steam inlet connection.

G. Install hose end valve to drain shell.

H. Install thermometer on heat-exchanger and inlet and outlet piping, and install thermometer on heating-fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 230519 "Meters and Gages for HVAC Piping."

I. Install pressure gages on heat-exchanger and heating-fluid piping. Comply with requirements for pressure gages specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Heat exchanger will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain heat exchangers.

END OF SECTION 235700

SECTION 237200 - AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Heat wheels.
2. Packaged energy recovery units.

1.3 PERFORMANCE REQUIREMENTS

A. Engineering Criteria Submittal: Provide vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and engineering criteria indicated.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.
2. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

D. Engineering Services Submittal: For air-to-air energy recovery equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of air-to-air energy recovery equipment.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
3. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which equipment or suspension systems will be attached.

B. Seismic Qualification Certificates: For air-to-air energy recovery equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of each type of filter specified.
2. Fan Belts: One set(s) of belts for each belt-driven fan in energy recovery units.
3. Wheel Belts: One set(s) of belts for each heat wheel.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ARI Compliance:

1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
2. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

C. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

D. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.

E. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."
2. Electric coils shall comply with requirements in UL 1995, "Heating and Cooling Equipment."

1.9 COORDINATION

A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Packaged Energy Recovery Units: Two years.
2. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 HEAT WHEELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Thermal Technologies.
2. Airxchange Inc.
3. American Energy Exchange, Inc.
4. Loren Cook Company.
5. SEMCO Incorporated.
6. Trane; American Standard Companies, Inc.

B. Casing:

1. Steel with standard factory-painted finish.
2. Integral purge section limiting carryover of exhaust air to between 0.05 percent at 1.6-inch wg and 0.20 percent at 4-inch wg differential pressure.
3. Casing seals on periphery of rotor and on duct divider and purge section.
4. Support vertical rotors on grease-lubricated ball bearings having extended grease fittings or permanently lubricated bearings. Support horizontal rotors on tapered roller bearing.

C. Rotor: Aluminum segmented wheel strengthened with radial spokes.

1. Maximum Solid Size for Media to Pass: 900 micrometer.

D. Drive: Fractional horsepower motor and gear reducer, with speed changed by variable frequency controller and self-adjusting multilink belt around outside of rotor.

1. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

E. Controls:

1. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
2. Variable frequency controller, factory mounted and wired, permitting input of field connected 4-20 mA or 1-10-V control signal.
3. Variable frequency controller, factory mounted and wired, with exhaust-air sensor to vary rotor speed and maintain exhaust temperature above freezing.
4. Variable frequency controller, factory mounted and wired, with exhaust- and outdoor-air sensors, automatic changeover thermostat and set-point adjuster, to vary rotor speed and maintain air differential temperature above set point. Rotor speed shall increase to maximum when exhaust-air temperature is less than outdoor-air temperature.

5. Pilot-Light Indicator: Display rotor rotation and speed.
6. Speed Settings: Adjustable settings for maximum and minimum rotor speed limits.

2.2 PACKAGED ENERGY RECOVERY UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Thermal Technologies.
2. American Energy Exchange, Inc.
3. Applied Air; Mestek Technology, Inc.
4. Carnes.
5. Des Champs Technologies.
6. Engineered Air.
7. Fairchild Industrial Products Company.
8. Gaylord Industries, Inc.
9. Greenheck Fan Corporation.
10. Loren Cook Company.
11. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
12. Mitsubishi Electric Sales Canada Inc.
13. RenewAire LLC.
14. SEMCO Incorporated.
15. Trane; American Standard Companies, Inc.
16. Venmar CES Inc.
17. Wing, L. J.; Mestek Technology, Inc.

B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, hinged access doors with neoprene gaskets for inspection and access to internal parts, minimum 1-inch- thick thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.

D. Heat Recovery Device: Fixed-plate heat exchanger.

E. Supply and Exhaust Fans: Forward-curved, centrifugal fan with spring isolators and insulated flexible duct connections.

1. Motor and Drive: Belt driven with adjustable sheaves, motor mounted on adjustable base.
2. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
4. Spring isolators on each fan having 1-inch static deflection.

F. Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
3. Factory-fabricated, viscous-coated, flat-panel type.
4. Thickness: 2 inches.
5. Minimum Arrestance: 80, according to ASHRAE 52.1.
6. Minimum Merv: 5, according to ASHRAE 52.2.
7. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
8. Frame: Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

G. Piping and Wiring: Fabricate units with space within housing for piping and electrical conduits. Wire motors and controls so only external connections are required during installation.

1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
2. Outdoor Enclosure: NEMA 250, Type 3R enclosure contains relays, starters, and terminal strip.
3. Include nonfused disconnect switches.
4. Variable-speed controller to vary fan capacity from 100 to approximately 50 percent.

H. Accessories:
1. Low-Leakage, Isolation Dampers: Double-skin, airfoil-blade, dampers with compressible jamb seals and extruded-vinyl blade edge seals, in opposed or parallel-blade arrangement with steel operating rods rotating in stainless-steel sleeve bearings mounted in a single frame, with operating rods connected with a common linkage, and electric damper operator factory wired. Leakage rate shall not exceed 5 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft. at 4-inch wg.
2. Duct flanges.
3. Rubber-in-shear isolators for ceiling-mounted units.
4. Hinged access doors with quarter-turn latches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install heat wheels so supply and exhaust airstreams flow in opposite directions and rotation is away from exhaust side to purge section to supply side.

1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to wheel surfaces, drive motor, and seals.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

B. Suspended Units: Suspend units from structural-steel support frame using threaded steel rods and spring hangers. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC Piping and Equipment."

C. Install units with clearances for service and maintenance.

D. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

E. Pipe drains from drain pans to nearest floor drain; use ASTM B 88, Type L, drawn-temper copper water tubing with soldered joints, same size as condensate drain connection.

F. Pipe drains from drain pans to nearest floor drain; use ASTM D 1785, Schedule 40 PVC pipe and solvent-welded fittings, same size as condensate drain connection.

1. Requirements for Low-Emitting Materials:

a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Connect piping to units mounted on vibration isolators with flexible connectors.

D. Comply with requirements for ductwork specified in Section 233113 "Metal Ducts."

E. Install electrical devices furnished with units but not factory mounted.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Adjust seals and purge.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Set initial temperature and humidity set points.
5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

D. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION 237200

SECTION 237313

MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:
   1. Variable-air-volume, single-zone air-handling units

1.3 PERFORMANCE REQUIREMENTS

A. Engineering Criteria Submittal: Provide vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.

1.4 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.

   1. Unit dimensions and weight.
   2. Cabinet material, metal thickness, finishes, insulation, and accessories.
   3. Fans:

      a. Certified fan-performance curves with system operating conditions indicated.
      b. Certified fan-sound power ratings.
      c. Fan construction and accessories.
      d. Motor ratings, electrical characteristics, and motor accessories.

   4. Certified coil-performance ratings with system operating conditions indicated.
   5. Dampers, including housings, linkages, and operators.
   6. Filters with performance characteristics.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Engineering Services Submittal: For vibration isolation indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each air-handling unit fan.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Carrier Corporation; a member of the United Technologies Corporation Family.
2. Mammoth Inc.
3. McQuay International
4. Trane; American Standard Inc.
5. YORK International Corporation.
6. Haakon.
7. SEMCO

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:

1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
2. Casing Joints: Sheet metal screws or pop rivets.
3. Sealing: Seal all joints with water-resistant sealant.
4. Factory Finish for Steel and Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Casing Insulation and Adhesive:

1. Materials: ASTM C 1071, Type II.

2. Location and Application: Encased between outside and inside casing.

C. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:

   a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
   b. Gasket: Neoprene, applied around entire perimeters of panel frames.
   c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:

   a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
   b. Gasket: Neoprene, applied around entire perimeters of panel frames.
   c. Size: At least 24 inches wide by full height of unit casing up to a maximum height of 72 inches.

4. Locations and Applications:

   a. Fan Section: Doors and inspection and access panels.
   b. Access Section: Doors.
   c. Coil Section: Inspection and access panel.
   d. Damper Section: Inspection and access panels.
   e. Filter Section: Inspection and access panels large enough to allow periodic removal and installation of filters.
   f. Mixing Section: Doors.
   g. Humidifier Section: Doors.

D. Condensate Drain Pans:

1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.

   a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
   b. Depth: A minimum of 2 inches deep.

2. Formed sections.
3. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
4. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

    a. Minimum Connection Size: NPS 1 (DN 25).

5. Pan-Top Surface Coating: Asphaltic waterproofing compound.
6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

E. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2.3 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.

    a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
    b. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Horizontal-Flanged, Split Housing: Bolted construction.
3. Housing for Supply Fan: Attach housing to fan-section casing with metal-edged flexible duct connector.
4. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch thick, galvanized-steel sheet or 0.032-inch- thick aluminum sheets; select metal compatible with casing.

    a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

        1) Fabric Minimum Weight: 26 oz./sq. yd.
        2) Fabric Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
        3) Fabric Service Temperature: Minus 40 to plus 200 deg F

C. Plenum Fan Housings: Steel frame and panel; fabricated without fan scroll and volute housing.

D. Backward-Inclined, Centrifugal Fan Wheels: Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

E. Forward-Curved, Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

F. Fan Shaft Bearings:

1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 120,000 hours according to ABMA 9.

G. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
2. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.

H. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 2 inche

I. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
4. Mount unit-mounted disconnect switches on exterior of unit.

J. Variable Frequency Controllers:

1. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
2. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
3. Unit Operating Requirements:

a. Input ac voltage as described on drawings.
b. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
c. Minimum Efficiency: 96 percent at 60 Hz, full load.
d. Minimum Displacement Primary-Side Power Factor: 96 percent.

e. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
f. Starting Torque: 100 percent of rated torque or as indicated.
g. Speed Regulation: Plus or minus 1 percent.

4. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
5. Internal Adjustability Capabilities:

a. Minimum Speed: 5 to 25 percent of maximum rpm.
b. Maximum Speed: 80 to 100 percent of maximum rpm.
c. Acceleration: 2 to a minimum of 22 seconds.
d. Deceleration: 2 to a minimum of 22 seconds.
e. Current Limit: 50 to a minimum of 110 percent of maximum rating.

6. Self-Protection and Reliability Features:

a. Input transient protection by means of surge suppressors.
b. Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
c. Adjustable motor overload relays capable of NEMA ICS 2, Class 10 performance.
d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
e. Instantaneous line-to-line and line-to-ground overcurrent trips.
f. Loss-of-phase protection.
g. Reverse-phase protection.
h. Short-circuit protection.
i. Motor overtemperature fault.

7. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
8. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped.
9. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
10. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
11. Door-mounted LED status lights shall indicate the following conditions:

a. Power on.
b. Run.
c. Overvoltage.
d. Line fault.
e. Overcurrent.
f. External fault.

12. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual-speed-control potentiometer and elapsed time meter.
13. Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:

    a. Output frequency (Hertz).
    b. Motor speed (rpm).
    c. Motor status (running, stop, fault).
    d. Motor current (amperes).
    e. Motor torque (percent).
    f. Fault or alarming status (code).
    g. Proportional-integral-derivative (PID) feedback signal (percent).
    h. DC-link voltage (volts direct current).
    i. Set-point frequency (Hertz).
    j. Motor output voltage (volts).

14. Control Signal Interface:

    a. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
    b. Remote signal inputs capable of accepting any of the following speed-setting input signals from the control system:

        1) 0 to 10-V dc.
        2) 0-20 or 4-20 mA.
        3) Potentiometer using up/down digital inputs.
        4) Fixed frequencies using digital inputs.
        5) RS485.
        6) Keypad display for local hand operation.

    c. Output signal interface with a minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:

        1) Output frequency (Hertz).
        2) Output current (load).
        3) DC-link voltage (volts direct current).
        4) Motor torque (percent).
        5) Motor speed (rpm).
        6) Set-point frequency (Hertz).

    d. Remote indication interface with a minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

        1) Motor running.
        2) Set-point speed reached.
        3) Fault and warning indication (overtemperature or overcurrent).
        4) High- or low-speed limits reached.

15. Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be

programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

16. Integral Disconnecting Means: NEMA AB 1, molded-case switch, – OR - NEMA KS 1, nonfusible switch, - OR - NEMA KS 1, fusible switch, - ALL with lockable handle.
17. Accessories:

    a. Devices shall be factory installed in controller enclosure unless otherwise indicated.
    b. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
    c. Standard Displays:

        1) Output frequency (Hertz).
        2) Set-point frequency (Hertz).
        3) Motor current (amperes).
        4) DC-link voltage (volts direct current).
        5) Motor torque (percent).
        6) Motor speed (rpm).
        7) Motor output voltage (volts).

2.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.

2.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV8) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Disposable Panel Filters:

1. Factory-fabricated, viscous-coated, flat-panel type.
2. Thickness: 2 inches
3. Dust-Holding Capacity: 10 lb
4. Initial Resistance: 0.25 inches wg
5. Recommended Final Resistance: 1.00 inches wg

6. Merv (ASHRAE 52.2): 8.
7. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
8. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

C. Filter Gage:

1. 3-1/2-inch- diameter, diaphragm-actuated dial in metal case.
2. Vent valves.
3. Black figures on white background.
4. Front recalibration adjustment.
5. 2 percent of full-scale accuracy.
6. Range: 0- to 3.0-inch wg (0 to 750 Pa).
7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch aluminum tubing, and 2- or 3-way vent valves.

2.6 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpmface velocity through damper and 4-inch wg pressure differential.

B. Damper Operators: Comply with requirements in Section 230900 "Instrumentation and Control for HVAC."

C. Zone Dampers: Two single-blade, galvanized-steel dampers offset 90 degrees from each other onsteel operating rod rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame. Provide blade gaskets and edge seals, and mechanically fasten blades to operating rod.

D. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement withsteel operating rods rotating in stainless-steel sleeve bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft. at 4-inch wg

E. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.

F. Combination Filter and Mixing Section:

1. Cabinet support members shall hold 2-inch- thick, pleated, flat, permanent or throwaway filters.
2. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.

2.7 CAPACITIES AND CHARACTERISTICS

A. Heating Coil:
1. Coil Type: Continuous circuit Self-draining Cleanable.
2. Tube Material: Copper.
3. Fin Type: Plate.
4. Fin Material: Aluminum.
5. Fin and Tube Joint: Mechanical bond.
6. Headers:

    a. Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
    b. Seamless copper tube with brazed joints, prime coated.
    c. Fabricated steel, with brazed joints, prime coated.
    d. Provide insulated cover to conceal headers exposed outside casings.

7. Frames: Channel frame, 0.064-inch thick galvanized steel.
8. Coil Working-Pressure Ratings: 200 psig , 325 deg F

B. Cooling Coil:
1. Coil Type: Continuous circuit Self-draining Cleanable.
2. Tube Material: Copper.
3. Fin Type: Plate.
4. Fin Material: Aluminum.
5. Fin and Tube Joint: Mechanical bond.
6. Headers:

    a. Cast iron with cleaning plugs and drain and air vent tappings extended to exterior of unit.
    b. Seamless copper tube with brazed joints, prime coated.
    c. Fabricated steel, with brazed joints, prime coated.
    d. Provide insulated cover to conceal headers exposed outside casings.

7. Frames: Channel frame, 0.064-inch- thick galvanized steel.
8. Coil Working-Pressure Ratings: 200 psig (1380 kPa), 325 deg

2.8 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting: Install air-handling units on concrete bases without vibration isolation devices. Secure units to anchor bolts installed in concrete bases. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete." Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4 (DN 32), ASTM B 88, Type M (ASTM B 88M, Type C) copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Section 232113 "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
2. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that zone dampers fully open and close for each zone.
7. Verify that face-and-bypass dampers provide full face flow.
8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
9. Comb coil fins for parallel orientation.
10. Verify that proper thermal-overload protection is installed for electric coils.
11. Install new, clean filters.
12. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 237313

SECTION 238146

WATER-SOURCE UNITARY HEAT PUMPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.02 SUMMARY

A. This Section includes the following types of water-source heat pumps:

1. Exposed, floor-mounted console units.

1.03 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each model.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Floor plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which heat pumps will be attached.

2. Housekeeping slabs for heat pumps .

3. Racks for heat pumps mounted one above other

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of unit indicated.

F. Product Certificates: For each type of water-source heat pump, signed by product manufacturer.

G. Manufacturer Seismic Qualification Certification: Submit certification that water-source heat pumps, accessories, and components will withstand seismic forces defined in Division 23 Section "Mechanical Vibration and Seismic Controls." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Field quality-control test reports.

I. Operation and Maintenance Data: For water-source heat pumps to include in emergency, operation, and maintenance manuals.

J. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of water-source heat pumps and are based on the specific system indicated. Refer to DDC General Conditions.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with ASHRAE 15.

D. Comply with minimum COP/efficiency levels according to ASHRAE/IESNA 90.1.

E. Comply with NFPA 70.

F. Comply with safety requirements in UL 484 for assembly of free-delivery water-source heat pumps.

G. Comply with safety requirements in UL 1995 for duct-system connections.

1.05 COORDINATION

A. Coordinate layout and installation of water-source heat pumps and suspension components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, and partition assemblies.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water-source heat pumps that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, refrigeration components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 WATER SOURCE HEAT PUMPS (REVERSIBLE WATER CHILLERS)

A. Manufacturers

1. Water Furnace EW Series

2. Climate Master

3. FHP Manufacturing Inc

4. York International

5. Florida Heat Pump

6. Multistack

B. Description: Factory assembled and tested, single packaged water-source heat pump consisting of 10 gauge welded steel frame with powder coat paint, sealed refrigerant circuit including two compressors, two refrigerant to water heat exchangers, bi-directional thermal expansion valve, reversing valve, and reverse cycle refrigeration controls. The unit and all refrigeration components shall be rated for use with R-410A refrigerant. Field conversion of refrigerants will not be allowed.

C. Acoustical Enclosure: Provide heavy gauge galvanized steel casing with electro-statically painted finish. Provide access panels for inspection and access to internal components. Insulate panels with a minimum ½ inch thick, 15 lb./cu.ft. density, coated fiberglass insulation. All insulation must meet NFPA 90A.

D. Refrigerant to Water Heat Exchangers: Brazed plate type heat exchangers with 316 stainless steel plates capable of withstanding 650 psig working pressure on the refrigerant side and 450 psig on the water side. Heat exchangers are to be insulated with ½" inch thick, 1.5 lb./cu.ft. density, closed cell polyethylene foam insulation. Heat exchangers to have interlaced water circuit with individual refrigerant circuits.

E. Compressor: Provide hermetic, high efficiency, scroll type compressor installed on neoprene isolators and enclosed in acoustically treated enclosure. Provide high and low temperature cutouts, and compressor motor overload protection. Provide capability to reset compressor lockout circuit at either remote thermostat or circuit breaker.

F. Refrigeration Components: Provide 4-way, electro-magnetically activated solenoid refrigerant reversing valve designed for fail-safe operation in the cooling position. The solenoid coil assembly must be detachable from valve body. Provide a bi-directional, thermostatic expansion valve to deliver proper superheat over the complete range of operating water temperatures. Provide liquid line filter dryers on each refrigerant circuit.

G. Water Piping Connections: The unit shall have one set of entering and leaving water connections The connection shall be a 2 inch Victaulic type

H. Unit Controls:

1. Provide factory-mounted and factory-wired controls for sequenced operation of compressors and reversing valves. A 24-volt, minimum 75VA transformer with integral circuit breaker shall provide power to the low voltage controls. Provide safety lockout control with refrigerant high-pressure switch, refrigerant low-pressure or loss of charge switch, and water freeze protection. The lockout circuit shall be capable of being reset by either resetting the low voltage power supply or the main unit circuit breaker.
2. Microprocessor Control: Provide a factory installed programmable, microprocessor control that sequences all unit functions and modes of operation.

Microprocessor to have minimum run times, internal lead lag, minimum off times, compressor start delays, and minimum changeover times.

3. The control shall be capable of interface with supervisory controllers using N2 Open, BAC-Net communication protocols.
4. Microprocessor to have the following temperatures available at the unit or on the network

    a. Entering Source Fluid Temperature

    b. Leaving Source Fluid Temperature

    c. Entering Load Fluid Temperature

    d. Leaving Load Fluid Temperature

    e. Circuit 1 Source Refrigerant Temperature

    f. Circuit 2 Source Refrigerant Temperature

    g. Circuit 1 Load Refrigerant Temperature

    h. Circuit 2 Load Refrigerant Temperature

5. Microprocessor to have the following binary values available at the unit or on the network

    a. Compressor 1 ENABLE

    b. Compressor 2 ENABLE

    c. Reversing Valve ENABLE

    d. Compressor 1 STATUS

    e. Compressor 2 STATUS

    f. Compressor 1 COMMANDED STATUS

    g. Compressor 2 COMMMANDED STATUS

    h. Reversing Valve COMMANDED STATUS

    i. Load Flow Switch STATUS

    j. Source Flow Switch STATUS

6. Unit to have the following alarms

    a. Source Freeze Circuit 1

    b. Source Freeze Circuit 2

    c. Load Freeze Circuit 1

d. Load Freeze Circuit 2

e. Source Flow Switch

f. Load Flow Switch

g. High Pressure Circuit 1

h. High Pressure Circuit 2

i. Low Pressure Circuit 1

j. Low Pressure Circuit 2

k. Low Refrigerant Charge Circuit 1

l. Low Refrigerant Charge Circuit 2

7. Unit to have adjustable freeze protection settings. Refrigerant sensors on liquid line to be used for freeze protection.
8. Unit to have four network programmable binary outputs for valve and pump control.
9. Unit to have terminal strip
10. Control Display: Provide a factory installed LCD display. The 4 z 20 digit backlit screen shall be capable of displaying all internal analog and binary values. LCD display to be used for alarm monitoring, status, and settings.

2.03 Chiller Plant Master Controller

A. Heat Pump manufacturer to provide master controller that will control all units, primary pumps, and source water valves. Master controller to be Tridium JACE 201 or equal. Master controller to stage heat pumps in order to maintain a common leaving water set point.

B. Heat pump manufacturer to provide water temperature sensors to the ATC for control purposes. Each system will have a common entering and leaving water sensor located in the primary piping. The sensor will be installed by the ATC and wired back to the master controller.

C. Load pumps to be controlled by the unit. Flow proving will be done by current switches. Current switches are to be provided by the ATC and wired to the unit control board. One pump per system to be running at all times when the system is enabled to ensure proper flow over the temperature sensors.

D. Source water valves to be controlled by the unit. Flow proving will be done by DP switches. DP switches are to be provided by the ATC and wired to the unit control board. Source water valves are to be provided by the ATC – valves shall be two way, normally closed, spring return, 24V.

E. Communication between the master controller and the BAS shall be BACnet IP

F. BMS Vendor shall provide and install all control wiring

G. Master controller will have no control over the secondary pumps.

H. BMS to send the following commands over BACnet IP

1. System 1 enable/disable
2. System 1 mode – heating or cooling
3. System 1 heating set point
4. System 1 cooling set point
5. System 2 enable/disable
6. System 2 mode – heating or cooling
7. System 2 heating set point
8. System 2 cooling set point

I. BMS to monitor all temperatures and alarms from the units through the master controller

J. Maximum entering load water temperature for system change over is 85F – from heating to cooling.

K. Heat pump manufacturer to perform factory start up and network integration assistance on site.

L. Heat pump manufacturer to provide two extra water temperature sensors to ATC. Sensors to be kept on site at all times.

2.04 PUMP MODULE

A. See schedules on drawings

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of water-source heat pumps.

B. Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduit before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Concrete Bases: Install floor mounting units on 4-inch- high concrete bases. See Division 23 Section "Mechanical General Conditions " for concrete base materials and fabrication requirements.

B. Mount water-source heat pumps on concrete base with vibration isolators and seismic restraints. Vibration isolators are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

1. Units with Internally Isolated Fans and Compressors: Support on concrete bases using neoprene pads with minimum 0.125-inch static deflection. Secure units to anchor bolts installed in concrete bases.
2. Floor-Mounted Units: Support on concrete bases using housed-spring isolators with minimum 1-inch static deflection. Secure units to anchor bolts installed in concrete bases.

C. Install wall-mounting thermostats, humidistats, and switch controls in electrical outlet boxes at heights to match lighting controls or as required in Division 23 Section "HVAC Instrumentation and Controls."

3.03 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping to heat pump with unions and shutoff valves or hose kits.
2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

B. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts. Specific connection requirements are as follows:

1. Connect supply and return ducts to water-source heat pumps with flexible duct connectors specified in Division 23 Section "Duct Accessories."
2. Install ducts to termination in roof curb.
3. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
5. Install normal-weight, 3000 psi, compressive-strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified in Division 3.

C. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

D. Install piping adjacent to machine to allow service and maintenance.

E. Ground equipment according to Division 26 Section "Grounding and Bonding."

F. Connect wiring according to Division 26 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect internal insulation.
3. Verify that labels are clearly visible.
4. Verify that clearances have been provided for servicing.
5. Verify that controls are connected and operable.
6. Adjust vibration isolators.
7. Start unit according to manufacturer's written instructions.
8. Complete startup sheets and attach copy with Contractor's startup report.
9. Inspect and record performance of interlocks and protective devices; verify sequences.
10. Operate unit for an initial period as recommended or required by manufacturer.
11. Verify thermostat and humidistat calibration.
12. Inspect controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.

3.06 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.07 CLEANING

A. Replace filters used during construction prior to air balance or substantial completion.

B. After completing installation of exposed, factory-finished water-source heat pumps, inspect exposed finishes and repair damaged finishes.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain water-source heat pumps.

END OF SECTION

SECTION 238219

FAN COIL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes fan-coil units and accessories.

1.3 DEFINITIONS

A. BAS: Building automation system.

1.4 ACTION SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of fan-coil unit indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension components.
2. Structural members to which fan-coil units will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.

5. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Manufacturer Seismic Qualification Certification: Submit certification that fan-coil units, accessories, and components will withstand seismic forces defined in Section 230548 "Vibration and Seismic Controls for HVAC." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. Additionally, include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Coil-Unit Filters: Furnish 1 spare filter(s) for each filter installed.
2. Fan Belts: Furnish 1 spare fan belt(s) for each unit installed.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.9 COORDINATION

A. Coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate size and location of wall sleeves for outdoor-air intake.

PART 2 - PRODUCTS

2.1 FAN-COIL UNITS

A. Manufacturers:
1. Carrier Corporation.
2. Engineered Air Ltd.
3. Environmental Technologies, Inc.
4. International Environmental Corporation.
5. McQuay International.
6. Trane.
7. YORK International Corporation.

B. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

C. Coil Section Insulation: 1-inch thick, coated glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Main and Auxiliary Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1. Drain pans shall be removable.

E. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.

F. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Commissioner .

1. Vertical Unit Front Panels: Removable, steel, with integral stamped steel discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with integral stamped discharge grilles.
3. Stack Unit Discharge and Return Grille: Aluminum double-deflection discharge grille, and louvered- or panel-type return grille; color as selected by Commissioner from manufacturer's custom colors. Return grille shall provide maintenance access to fan-coil unit.
4. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

G. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Washable Foam: 70 percent arrestance and 3 MERV.
2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
3. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

I. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Wiring Termination: Connect motor to chassis wiring with plug connection.

J. Factory, Hydronic Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
1. Two-way, modulating control valve for chilled-water coil.
2. Two-way, modulating control valve for heating coil.
3. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.

    a. Length: 36 inches.
    b. Minimum Diameter: Equal to fan-coil-unit connection size.

4. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
5. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig working pressure, 250-deg F maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
6. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston

spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig.

7. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.
8. Wrought-Copper Unions: ASME B16.22.
9. Risers: ASTM B 88, Type L copper pipe with hose and ball valve for system flushing.

K. Control devices and operational sequences are specified in Section 230900 "Instrumentation and Control for HVAC" and Section 230993 "Sequence and Operations for HVAC Controls."

L. Basic Unit Controls:

1. Control voltage transformer.
2. Wall-mounting thermostat with the following features:
    a. Heat-cool-off switch.
    b. Fan on-auto switch.
    c. Fan-speed switch.
    d. Automatic changeover.
    e. Adjustable deadband.
    f. Concealed set point.
    g. Concealed indication.
    h. Degree F indication.
3. Unoccupied-period-override push button.
4. Data entry and access port.
    a. Input data includes room temperature, and humidity set points and occupied and unoccupied periods.
    b. Output data includes room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.

M. BAS Interface Requirements:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation.
3. Provide BACnet interface for central BAS workstation for the following functions:
    a. Adjust set points.
    b. Fan-coil-unit start, stop, and operating status.
    c. Data inquiry, including supply- and room-air temperature.
    d. Occupied and unoccupied schedules.

N. Electrical Connection: Factory wire motors and controls for a single electrical connection.

O. Capacities and Characteristics:
    1. Refer to mechanical drawings.

2.2 DUCTED FAN-COIL UNITS

A. Manufacturers:

1. Carrier Corporation.
2. Engineered Air Ltd.
3. Environmental Technologies, Inc.
4. International Environmental Corporation.
5. McQuay International.
6. Trane.
7. YORK International Corporation.

B. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

C. Coil Section Insulation: 1-inch thick foil-faced glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Drain Pans: Stainless steel. Fabricate pans and drain connections to comply with ASHRAE 62.1.

E. Chassis: Galvanized steel where exposed to moisture, with baked-enamel finish and removable access panels.

F. Cabinets: Steel with baked-enamel finish in manufacturer's standard paint color.

1. Supply-Air Plenum: Sheet metal plenum finished and insulated to match the chassis with mill-finish, aluminum, double-deflection grille.
2. Return-Air Plenum: Sheet metal plenum finished to match the chassis.
3. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor- and return-air, formed-steel dampers.
4. Dampers: Galvanized steel with extruded-vinyl blade seals, flexible-metal jamb seals, and interlocking linkage.

G. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Washable Foam: 70 percent arrestance and 3 MERV.
2. Glass Fiber Treated with Adhesive: 80 percent arrestance and 5 MERV.
3. Pleated Cotton-Polyester Media: 90 percent arrestance and 7 MERV.

H. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

I. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the cabinet. Aluminum or painted-steel wheels, and painted-steel or galvanized-steel fan scrolls.

1. Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

J. Factory, Hydronic Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Two-way, modulating control valve for chilled-water coil.
2. Two-way, modulating control valve for heating coil.
3. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.

   a. Length: 36 inches.
   b. Minimum Diameter: Equal to fan-coil-unit connection size.

4. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
5. Calibrated-Orifice Balancing Valves: Bronze body, ball type; 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
6. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig working pressure at 250 deg F; with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig.
7. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig working pressure, with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.
8. Wrought-Copper Unions: ASME B16.22.
9. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."

   a. Motor: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

10. Accessories: Polyethylene mounting base to provide a permanent foundation.

K. Control devices and operational sequence are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

L. Basic Unit Controls:

1. Control voltage transformer.
2. Wall-mounting thermostat with the following features.

   a. Heat-cool-off switch.

b. Fan on-auto switch.
c. Fan-speed switch.
d. Automatic changeover.
e. Adjustable deadband.
f. Concealed set point.
g. Concealed indication.
h. Degree F indication.

M. BAS Interface Requirements:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation.
3. Provide BACnet interface for central BAS workstation for the following functions:

a. Adjust set points.
b. Fan-coil-unit start, stop, and operating status.
c. Data inquiry includingsupply- and room-air temperature.
d. Occupied and unoccupied schedules.

N. Electrical Connection: Factory wire motors and controls for a single electrical connection.

O. Capacities and Characteristics:
1. Refer to mechanical drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

D. Verify locations of thermostats, and other exposed control sensors with Drawings and room details before installation. Install devices 60 inches above finished floor.

E. Install new filters in each fan-coil unit within two weeks after Substantial Completion.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Connect piping to fan-coil-unit factory hydronic piping package. Install piping package if shipped loose.
3. Connect condensate drain to indirect waste.

    a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

    b. Where FCU condensate cannot be routed to indirect drain by gravity, provide Little Giant VCMX-20 condensate pump or equivalent, and route to indirect drain.

B. Connect supply and return ducts to fan-coil units with flexible duct connectors specified in Section 233300 "Air Duct Accessories." Comply with safety requirements in UL 1995 for duct connections.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain fan-coil units.

END OF SECTION 238219

SECTION 238236

FINNED-TUBE RADIATION HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes hydronic, baseboard and finned-tube radiation heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details and dimensions of custom-fabricated enclosures.
4. Indicate location and size of each field connection.
5. Indicate location and arrangement of piping valves and specialties.
6. Indicate location and arrangement of integral controls.
7. Include enclosure joints, corner pieces, access doors, and other accessories.
8. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

D. Color Samples for Initial Selection: For finned-tube radiation heaters with factory-applied color finishes.

E. Color Samples for Verification: For each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members, including wall construction, to which finned-tube radiation heaters will be attached.
2. Method of attaching finned-tube radiation heaters to building structure.
3. Penetrations of fire-rated wall and floor assemblies.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 HOT-WATER BASEBOARD RADIATION HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. A.I.M. Radiant Heating.
2. Embassy Industries, Inc.
3. Haydon Corporation, Inc.
4. Hydro-Air Components Inc.
5. Rosemex.
6. Slant/Fin Corporation.
7. Sterling Hydronics; a Mestek company.
8. Vulcan
9. Jaga (basis of design)

B. Performance Ratings: Rate baseboard radiation heaters according to Hydronics Institute's "I=B=R Testing and Rating Standard for Baseboard Radiation."

C. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on polypropylene element glides. One end of tube shall be belled.
1. Capacities: Refer to mechanical drawings.

D. Enclosures: Minimum 0.0329-inch- thick steel, removable front cover.

1. Refer to schedule sheet for specific model number and requirements

2. Full-height back.
3. Full-length damper.
4. End panel.
5. End caps.
6. Inside and outside corners.
7. Valve access door.
8. Joiner pieces to snap together.

9. Enclosure Height: refer to mechanical drawings .
10. Enclosure Depth: refer to mechanical drawings .
11. Finish: Baked-enamel finish in manufacturer's custom color as selected by Commissioner.
12. Element Brackets: Primed and painted steel to support front panel and element.

E. Rust-Resistant Enclosures: Minimum 0.040-inch- thick ASTM A 653/A 653M, G60 galvanized-steel, removable front cover.

1. Refer to schedule sheet for specific model number and requirements

2. Full-height back.
3. Full-length damper.
4. End panel.
5. End caps.
6. Inside and outside corners.
7. Valve access door.
8. Joiner pieces to snap together.
9. Enclosure Height: refer to mechanical drawings.
10. Enclosure Depth: refer to mechanical drawings.
11. Finish: Baked-enamel finish in manufacturer's custom color as selected by Commissioner.
12. Element Brackets: Primed and painted steel to support front panel and element.

2.2 HOT-WATER FINNED-TUBE RADIATION HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Embassy Industries, Inc.
2. Engineered Air.
3. Hydro-Air Components Inc.
4. Quincy Hydronic Technology Inc.
5. Rosemex.
6. Slant/Fin Corporation.
7. Sterling Hydronics; a Mestek company.
8. Trane Inc.
9. Vulcan
10. Jaga (basis of design)

B. Performance Ratings: Rate finned-tube radiation heaters according to Hydronics Institute's "I=B=R Testing and Rating Standard for Finned-Tube (Commercial) Radiation."

C. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on element supports. One end of tube shall be belled.
1. Refer to mechanical drawings

D. Element Supports: Ball-bearing cradle type to permit longitudinal movement on enclosure brackets.

E. Front Panel: Minimum 0.0428-inch- thick steel.

F. Rust-Resistant Front Panel: Minimum 0.052-inch- thick, ASTM A 653/A 653M, G60 galvanized steel.

G. Wall-Mounted Back Panel: Minimum 0.0329-inch- thick steel, full height, with full-length channel support for front panel without exposed fasteners.

H. Floor-Mounted Pedestals: Conceal insulated piping at maximum 36-inch spacing. Pedestal-mounted back panel shall be solid panel matching front panel. Provide stainless-steel escutcheon for floor openings at pedestals.

I. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.

J. Finish: Baked-enamel finish in manufacturer's custom color as selected by Commissioner.

K. Damper: Knob-operated internal damper at enclosure outlet.

L. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.

M. Enclosure Style: Commissioner to review and approve.

N. Accessories: Filler sections, corners, relay sections, and splice plates all matching the enclosure and grille finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive finned-tube radiation heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for hydronic-piping connections to verify actual locations before installation of finned-tube radiation heaters.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BASEBOARD RADIATION HEATER INSTALLATION

A. Install units level and plumb.

B. Install enclosure continuously around corners, using outside and inside corner fittings.

C. Join sections with splice plates and filler pieces to provide continuous enclosure.

D. Install access doors for access to valves.

E. Install enclosure continuously from wall to wall.

F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

G. Install valves within reach of access door provided in enclosure.

H. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.

I. Install piping within pedestals for freestanding units.

3.3 FINNED-TUBE RADIATION HEATER INSTALLATION

A. Install units level and plumb.

B. Install enclosure continuously around corners, using outside and inside corner fittings.

C. Join sections with splice plates and filler pieces to provide continuous enclosure.

D. Install access doors for access to valves.

E. Install enclosure continuously from wall to wall.

F. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.

G. Install valves within reach of access door provided in enclosure.

H. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.

I. Install piping within pedestals for freestanding units.

3.4 CONNECTIONS

A. Piping installation requirements are specified in Section 232113 "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect hot-water finned-tube radiation heaters and components to piping according to Section 232113 "Hydronic Piping".

1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.

C. Install control valves as required by Section 230900 "Instrumentation and Control for HVAC."

D. Install piping adjacent to finned-tube radiation heaters to allow service and maintenance.

E. Ground electric finned-tube radiation heaters according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 238236

SECTION 238239.19

WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."

C. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Wiring Diagrams: Power, signal, and control wiring.

D. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following or approved equal:

1. Berko; Marley Engineered Products.
2. Chromalox, Inc.
3. Indeeco.
4. Markel Products Company; TPI Corporation.
5. Marley Engineered Products.
6. Ouellet Canada Inc.
7. QMark; Marley Engineered Products.
8. Trane Inc.
9. Solaronics
10. Approved equal

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Front Panel: Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Commissioner, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant

metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 238239.19

SECTION 238316

RADIANT HEATING HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Thermal radiant floor heating and cooling system.

B. The work in this section includes, but is not limited to the following:
   1. Complete radiant heating and cooling system as shown in the drawings and as specified. This system shall be fully integrated with the construction of the floor slab (completed by others).
   2. Coordination with floor slab, insulation, and vapor barrier.
   3. Coordination with the selection and installation of circulation pumps and distribution piping.
   4. System controls and automation, including sensors within floor slab.
   5. Manufacturer supported system startup and commissioning service.

C. Related Sections:
   1. DDC General Conditions

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Use an installer with demonstrated experience on projects of similar size and complexity and possessing documentation proving successful completion of radiant floor installation training by the PEX-A tubing manufacturer.

B. References
   1. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referenced to by issuing authority abbreviation and standard designation.

C. ASTM International
   1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

2. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
3. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM F 876 Standard Specification for Cross-linked Polyethylene (PEX-A) Tubing
5. ASTM F877 Standard Specification for Cross-linked Polyethylene (PEX-A) Plastic Hot- and Cold-Water Distribution Systems
6. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX-A Reinforcing Rings for Use with Cross-linked Polyethylene (PEX-A) Tubing

D. American National Standards Institute (ANSI)/Underwriters Laboratories, Inc. (UL)
1. ANSI/UL 263 Standard for Safety for Fire Tests of Building Construction and Materials

E. International Conference of Building Officials (ICBO) Evaluation Services
1. Evaluation Report No. 4407
2. Evaluation Report No. 514

F. International Code Council (ICC)
1. International Mechanical Code (IMC)
2. ICC Evaluation Service (ES) Evaluation Reporth No. ESR 1099

G. Plastics Pipe Institute (PPI)
1. Technical Report TR-3 Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplasic Pipe Materials
2. Technical Report TR-4 Recommended Hydrostatic Strengths and design stresses for Thermoplastic Piping and Fitting Compounds

H. International Association of Plumbing and Mechanical Officials (IAPMO)
1. Uniform Mechanical Code

I. Certifications: Provide letters of certification as follows
1. Installer is trained by the PEX-A tubing manufacturer to install radiant floor systems.
2. Installer uses skilled workers holding a trade qualification license or equivalent, or apprentices under the supervision of a licensed tradesperson.

J. Pre-installation Meetings
1. Verify project requirements, substrate conditions, floor coverings, manufacturer's installation instructions and warranty requirements.
2. Review project construction timeline to ensure compliance or discuss modifications as required.
3. Interface with other trade representatives to verify areas of responsibility.
4. Establish the frequency and construction phase the Commissioner intends for site visits and inspection by the PEX-A tubing manufacturer's representative.

1.4 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. PEX: Crosslinked polyethylene.

C. PEX/AL/PEX: Crosslinked polyethylene/aluminum/crosslinked polyethylene.

1.5 SYSTEM DESCRIPTION

A. Design Requirements
   1. Standard Grade hydrostatic pressure ratings from Platics Pipe Institue in accordance with TR-3 as listed in TR-4. The following Three Standard grade ratings are required.
      a. 200°F at 80 psi
      b. 180°F at 100 psi
      c. 73.4°F at 160 psi
   2. Certification of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 for the following PEX-A tubing sizes when installed uninsulated at a tube spacing not less than 18 inches apart.
      a. 3/8 inch
   3. Certification of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 for the following PEX-A tubing sizes when encased with 1/2 inch fiberglass insulation at tube spacing not less than 4 inches apart.
      a. 5/8 inch

B. Performance Requirements: Provide hydronic radiant floor cooling system that is manufactured, fabricated, and installed to comply with regulatory agencies and authorities with jurisdiction, and maintain performance criteria stated by the PEX-A tubing manufacturer without defects, damage, or failure.
   1. Show compliance with ASTM F877.
   2. Show compliance with DIN 4726 regarding oxygen diffusion concerns
   3. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through Underwriters Laboratories, Inc. (UL).
      a. UL Design No. K913 - 2 hour concrete floor/ceiling assemblies.

C. Radiant thermal floor system manufacturer shall have successfully completed 5 installations of similar type and scope. Manufacturer shall provide from the factory a full-time representative to supervise the complete design, detailing, coordination, installation, and commissioning of the thermal floor system.

D. The contractor shall furnish all labor, materials, tools, equipment, appliances, and services necessary to deliver and install all radiant floor dimension to the radiant floor manufacturer.

1.6 SUBMITTALS

A. General: Submit listed submittals in accordance with DDC General Conditions.

B. Product Data: For each type of radiant heating pipe, fitting, manifold, specialty, and control.

   1. For radiant heating piping and manifolds, include pressure and temperature rating, oxygen-barrier performance, fire-performance characteristics, and water flow and pressure drop characteristics.

C. Shop Drawings: Show piping layout and details drawn to scale, including valves, manifolds, controls, and support assemblies, and their attachments to building structure.

1. Shop Drawing Scale: 1/4 inch = 1 foot.

2. Submit shop drawings for piping installation in the project. Indicate all valves, pumps and items of equipment that are required to control and operate the radiant floor for both cooling and heating as shown on the drawings and described in the sequence of operations. Submit a valve and pump schedule listing each number, type, size, model and service. Cross reference to supporting product data

3. Submit manufacturer's detailed drawings showing layouts, fixing details and piping details of all areas where radiant floors are indicated along with product and performance data for each component.

4. Provide calculations which support the heating and cooling performance requirements of the radiant floor. These calculations should show the flow through the floor for heating and cooling as well as the primary heating and cooling connections to the radiant floor headers and control circuits. System pressure drop calculations are also to be provided.

5. Submit drawings showing details of manifolds, including all connections and valves. If manifolds are to be installed on a wall then the details should include all fixture details. If the manifolds are to be installed in wall cavities then all fixture and access details are to be provided.

6. Piping materials and temperature/pressure ratings.

7. Location of all expansion and penetration sleeves, showing coordination with concrete slab expansion joints. Provide confirmation of concrete slab expansion requirements and the use of any concrete additives.

8. Piping manifold locations and installation details. On the shop drawings indicating piping manifold locations indicate whether manifold is enclosed within an architecturally-provided cabinet or if a manufacturer-provided cabinet will be used.

9. Control sequences and control hardware devices. Indicate compliance and coordination with requirements of other specification sections.

10. Piping sample with certification of properties.

11. Submit manufacturer's report detailing that the radiant floor have been installed in accordance with this specification and the manufacturer's specified instructions.

12. Submit report indicating that installation was performed according to the manufacturer's instructions. Include pressure testing documentation as required in related specification sections.

13. Submit start-up report demonstrating that system meets required capacity is fully functional and has been commissioned to the satisfaction of system manufacturer.

14. Provide installation drawings indicating tubing layout, manifold locations, zoning requirements and manifold schedules with details required for installation of the system. Provide sectional drawing of floor slab demonstrating coordination with other construction trades and showing insulation if required.

D. Quality Assurance/Control Submittals: Submit the following:
   1. Test Reports: Upon request, submit test reports from recognized testing laboratories.

E. Documentation: Submit the following:
   1. Manufacturer's certificate indicating products comply with specified requirements.
   2. Manufacturer's detailed room-by-room heat-loss or gain analysis for the structure.
   3. Documentation indicating the installer is trained to install the manufacturer's products.

F. Closeout Submittals: Submit the following.
   1. Warranty documents specified herein.
   2. Operation and maintenance data.
   3. Manufacturer's field reports specified herein.
   4. Final as-built tubing layout drawings.

G. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members to which radiant heating piping will be attached.
   2. Items penetrating flooring, including the following:
      a. Masonry screws
      b. Perimeter moldings.

H. Operation and Maintenance Data: For radiant heating piping valves and equipment to include in operation and maintenance manuals.

1.7 DELIVERY, STORAGE AND HANDLING

A. General: Comply with DDC General Conditions.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
   1. Store PEX-A tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
   2. Do not expose PEX-A tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing that is exposed to direct sunlight.

1.8 WARRANTY

A. Project Warranty: Refer to DDC General Conditions for project warranty provisions.

B. Manufacturer's Warranty: Submit, for City of New York's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights City of New York may have under contract documents.
   1. Warranty Period for PEX-A Tubing: 30-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor.
   2. Warranty Period for Manifolds and Fittings: 5-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor.
   3. Warranty Period for Controls and Electrical Components: 2-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion when installed by a factory-trained contractor.
   4. If a factory-trained contractor does not install the system, then the most recent limited warranty published by the PEX-A tubing manufacturer takes precedence.

PART 2 - PRODUCTS

2.1 HYDRONIC RADIANT FLOOR HEATING AND COOLING SYSTEM

A. Manufacturers:
   1. Uponor, Inc
   2. REHAU Incorporated
   3. Slant/Fin Corporation
   4. Viega
   5. HeatLink Group Inc
   6. Heat Innovations Inc.
   7. Wirsbo

2.2 PRODUCT SUBSTITUTIONS

A. All products, components, etc., specified herein are manufactured by and/or available from the PEX-A tubing manufacturer.

B. Alternative equipment manufacturers must submit required data for all electrical, mechanical, structural, engineering, etc. revisions for an equivalent system for approval.

C. Alternative equipment manufacturers must submit completed radiant floor design layout to the Comissioner for approval.

D. Tubing manufactured utilizing the silane method of cross-linking (PEX-B) is not considered an acceptable alternate.

2.3 HYDRONIC RADIANT FLOOR COOLING SYSTEM EQUIPMENT

A. Tubing
1. Material: Crosslinked polyethylene (PEX-A) manufactured by PEX-A or Engle method
2. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency.
3. Pressure Ratings: Standard Grade hydrostatic design and pressure ratings as issued by the Plastics Pipe Institute (PPI), a division of the Society of the Plastics Industry (SPI).
4. Show compliance with ASTM E119 and ANSI/UL 263 through certification listings through UL.
   a. UL Design No. L557 — 1 hour wood frame floor/ceiling assemblies
   b. UL Design No. K913 — 2 hour concrete floor/ceiling assemblies
   c. UL Design No. U372 -- 1 hour wood stud/gypsum wallboard wall assemblies
   d. UL Design No. V444 — 1 hour steel stud/gypsum wallboard wall assemblies
5. Minimum Bend Radius (Cold Bending): No less than six times the outside diameter. Use the PEX tubing manufacturer's bend supports if radius is less than stated.
6. Barrier Tubing Type:
   a. Tubing shall have an oxygen diffusion barrier does not exceed an oxygen diffusion rate of 0.10 grams per cubic meter per day at 104 degrees F (40 degrees C) water-temperature in accordance with German DIN 4726.
   b. Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated in the system design.
7. Non-Barrier Tubing Type:
   a. Tubing does not feature an oxygen diffusion barrier.
   b. Nominal Inside Diameter: Provide tubing with nominal inside diameter in accordance with ASTM F876, as indicated in the system design.
8. An oxygen diffusion barrier tubing is not required if one of the following design strategies is used.
   a. Use non-ferrous components within the entire fluid pathway

B. Brass Manifolds
1. For system compatibility, use 114-inch brass manifolds offered by the respective PEX tubing manufacturer.
2. Manifold shall be constructed of dezincification resistant brass.
3. Appropriate sized manifolds boxes shall be supplied that allow the manifold assemblies to be mounted inside the wall cavity.
4. Use manifold mounting brackets offered by the respective PEX-A tubing manufacturer.
5. Manifolds must be capable of individual flow control for each loop on the manifold through valve actuators available from the manifold supplier.
6. Manifolds must feature manual flow balancing capability within the manifold body for balancing unequal loop lengths across the manifold.
7. Flow setter shall be installed on the return leg from the manifold to provide flow balancing between manifolds.
8. Manifolds support 5/16 inch through % inch PEX tubing.
9. Each manifold location should have the ability to vent air manually from the system.
10. Each manifold shall be protected by a cabinet or enclosure. Where a manifold enclosure has not been provided by the Commissioner, such as above a ceiling, in a mechanical room, or in a janitor's closet, the mechanical contractor shall install the manifold in a cabinet or enclosure.

C. Fittings
1. For system compatibility, use fittings offered by the PEX-A tubing manufacturer.
2. The fitting assembly consists of a barbed insert, a compression ring and a compression nut. The barbed insert is manufactured with an o-ring to facilitate air pressure testing.
3. Compression Fittings
   a. Fitting assembly manufactured from UNS C3600 series brass material.
   b. The fitting assembly consists of a barbed insert, a compression ring and a compression nut. The barbed insert is manufactured with an o-ring to facilitate air pressure testing.
4. Fittings or equivalent
   a. Fittings manufactured in accordance with ASTM F1960.
   b. Fitting assembly manufactured from material listed in paragraph 5.1 of ASTM F1960.The fitting assembly consists of a barbed adapter and an applicable sized PEX ring. The barbed insert may include an o-ring to facilitate pressure testing with air.

D. Supply-and-return Piping to the Manifolds (above ground piping)
1. Properly size supply and return distribution piping for the given volume and velocities required at system design.
2. Use suitable distribution piping material for all supply fluid temperatures in systems with ferrous components.
3. Use suitable distribution piping material for systems free of or isolated from ferrous components.
   a. When using HDPE mains, do not exceed 140 degrees F at 80 psi.
4. Do not expose PEX-A tubing to direct sunlight or install near overhead fluorescent lighting. If PEX-A tubing is exposed, install suitable pipe insulation around the exposed tubing.
5. Use fittings compatible with piping material. Fittings must transition from distribution piping to system manifolds.

E. Controls
1. Coordinate Controls with all other relevant specification sections
2. Radiant Cooling water temperature (Central System) Control (provided by radiant tubing manufacturer).
   a. This will be controlled by the control system provided by the radiant heating manufacturer.
      1) Router Main Control provides connections to the Digital Zone control module and the Network supply water temperature control. Provides a connection to the internet for remote viewing (optional). All connections are RJ45 and use Cat5 wire to communicate to devices. Includes control cabinet mounting screws and power connector.
      2) Network supply water temperature control provides connections to the mixing devices and secondary pumps. The Supply Water Temperature Control can control either modulating valves and radiant pumps . All connections are RJ45 and require the use of a Cat5 wire for the supply water temperature control to communicate with the other devises. Includes control cabinet mounting screws and power connector.
      3) Climate control network system control cabinet — low profile enclosure that houses all main controllers. Cabinet must be powder coated white and can be mounted in either a right hand or left hand hinged configuration.

3. Zoning control (Zoning system is provided by radiant tubing manufacturer)
   a. Controlled by a Digital zone control system
      1) Climate Control Network Thermostat with slab sensor is polarity — sensitive, flush mounted thermostat which includes an air sensor , humidity sensor (%RH) and option terminals for slab sensing if required.
      2) Digital Zone Control Module provides connections to the Network System thermostats and actuators. The DZCM requires 24VAC to power the controller and actuators. Actuators must have a Molex plug to for proper connection. The DZCM provides 3.5VDC to power the thermostats. The DZCM controller is addressed through a rotary switch.
      3) Router Main Control contains the communication ports for the DZCM . The router also has an Ethernet port to connect to the internet for remote viewing (optional) or UCT.
   b. The Digital thermostats will sense operative temperature (radiant surfaces + air temperature) , humidity and slab temperature.
   c. The Digital thermostats will send inputs of operative temperature , humidity , and slab temperature to the BMS system via open Bacnet protocol.

F. All equipment used shall be furnished from one radiant floor manufacturer and be fully compatible to work as one integrated system.

G. Provide flow balancing manifolds to be assembled with manual air vent, drain and refill valves, supply module with built in shut off valve, return module with manual flow regulating and balancing valve

H. General Contractor to provide high-density rigid board insulation for both base concrete structural slab and topping slab edge insulation where not provided by others. Minimum 2-inch thickness to be confirmed during shop drawing coordination. Insulation to be selected for compressive strength appropriate for this installation.

I. General Contractor provide control/monitoring devices, hardware equipment and software necessary to provide complete operating radiant floor system, independent of existing base building control system. Coordinate with requirements included in related specification sections.

J. Floor system shall be provided by manufacturer to achieve the following minimum performance requirements:
   1. Cooling: 15.0 Btu/hr per square foot, uniformly distributed over floor area served.
   2. Heating: 30.0 Btu/hr per square foot, uniformly distributed over floor area served.

K. Indoor space conditions at this peak cooling load shall be controlled to 55°F, 85% RH through 74°F, 60% RH at occupant level. Direct solar load is also assumed during peak output conditions.

2.4 ACCESSORIES

A. Use accessories associated with the installation of the radiant floor heating and cooling system as recommended by or available from the PEX tubing manufacturer.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, installation instructions and design drawings, including the following:
   1. Design Assistance Manuals and Radiant Floor Installation handbooks.

3.2 EXAMINATION

A. Examine surfaces and substrates to receive radiant heating piping for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Ensure that surfaces and pipes in contact with radiant heating piping are free of burrs and sharp protrusions.
   2. Ensure that surfaces and substrates are level and plumb.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATIONS

A. Install the following types of radiant heating piping for the applications described:
   1. Piping in Level Fill Concrete Floors (Not Reinforced): PEX.

3.4 INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop or Coordination Drawings.

B. Install radiant heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.

C. Connect radiant piping to manifold in a reverse-return arrangement.

D. Do not bend pipes in radii smaller than manufacturer's minimum bend radius dimensions.

E. Install manifolds in accessible locations as shown on drawings, or install access panels to provide maintenance access as required in Division 8 Section "Access Doors."

F. Fire- and Smoke-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials according to Division 7 Section "Firestops and Smokeseals."

G. Piping in Level Fill Concrete Floors (Not Reinforced):
   1. Secure piping in concrete floors by attaching pipes to subfloor using tracks, clamps, or staples.

2. Space tracks, clamps, or staples a maximum of 6" o.c., and at center of turns or bends.
3. Maintain 3/4-inch minimum cover.
4. Install a sleeve of 3/8-inch- thick, foam-type insulation or PE pipe around tubing and extending for a minimum of 10 inches on each side of slab joints to protect the tubing passing through expansion or control joints. Anchor sleeve to slab form at control joints to provide maximum clearance for saw cut.
5. Maintain minimum 40-psig pressure in piping during the concrete pour and continue for 24 hours during curing.

H. Revise locations and elevations from those indicated as required to suit field conditions and ensure integrity of piping and as approved by Commissioner.

I. After system balancing has been completed, mark balancing valves to permanently indicate final position.

J. Perform the following adjustments before operating the system:
1. Open valves to fully open position.
2. Check operation of automatic valves.
3. Set temperature controls so all zones call for full flow.
4. Purge air from piping.

K. After the concrete or plaster heating panel has cured as recommended by concrete or plaster supplier, operate radiant heating system as follows:
1. Start system heating at a maximum of 10 deg F above the ambient radiant panel temperature, and increase 10 deg F each following day until design temperature is achieved.

L. Next, operate Radiant Cooling System as follows:
1. Start system cooling at a maximum of 5 deg F below ambient radiant panel temperature, and decrease 5 deg F each following day until design temperature is reached.

M. Suspended Slab Construction:
1. Fasten the tubing to flat wire mesh or reinforcing bar, or snap into PEX rails in accordance with the PEX-A tubing manufacturer's installation recommendations.
2. Use closer tubing on-center distances along exterior walls. Increase tubing on-center distances as the installation moves away from the exterior wall.
   a. Use 6 inches (152mm) on center for exterior section of the design.
   b. Do not exceed 9 inches (229mm) on center for interior sections of the design.
   c. Do not install tubing within 6 inches (152mm) of all walls. d. Refer to the submitted radiant floor design layout for actual on center information.
3. The required insulation resistance value (R-value) is determined by the radiant floor design.
4. Use edge insulation when the radiant floor directly contacts an exterior wall or beam.
5. Install tubing at a consistent depth below the surface elevation as determined by the Commissioner. Ensure sufficient clearance to avoid control joint cuts.
6. Depending on the manufacturer's and Commissioner's recommendation, fibrous expansion joints may tolerate penetration.
7. For tubing that exits the slab in a 90-degree bend, use metal or PVC bend supports.

N. Length of loops and piping location/spacing to be determined by the manufacturer and approved by the Commissioner.

O. Verify high-density rigid board insulation and vapor barrier has been installed.

P. Insure that a minimum bending radius of 6 times piping diameter or per manufacturer's recommendations (if more stringent) is obtained.

Q. Piping to have a fully enclosed protective conduit where tubing first penetrates concrete flooring.

R. Provide a 12-inch (300mm) long protective sleeve where pipe crosses expansion joints.

S. Insure a minimum of a %-inch (6mm) thick foam or "sill gasket" expansion strip is placed against all inner and outer walls (i.e. where the topping comes in contact with a wall plate).

T. All piping to be identified with loop numbers marked on pipe wall before connecting to manifold using a permanent tag. 1. Verify actual loop length for each loop on a manifold. 2. Room identification plus loop number is to be printed and placed on each individual module in the manifold tag slot with the identification tags provided. 3. All loops must be identified to allow for future balancing.

U. Coordinate slab piping layout with other devices (electrical conduits and boxes, telecommunication conduits and boxes, plumbing penetrations, construction and furniture supports) and all other services within or attaching to the slab. Zones designated on the drawings shall be kept clear of all radiant floor piping.

V. Provide survey documentation of pipe layout on a 10 foot grid after installation of piping and prior to pouring concrete. Notify Commissioner 3 days in advance of concrete pour to allow inspection of installation and survey documentation.

W. Through-penetration Firestops.
1. Ensure compatibility of one- and two-hour rated through-penetration assemblies in accordance with ASTM E814.
2. Refer to the PEX-A tubing manufacturer for manufacturers that list PEX-A tubing with their firestop systems.

3.5 FIELD QUALITY CONTROL

A. Prepare radiant heating piping for testing as follows:
1. Open all isolation valves and close bypass valves.
2. Open and verify operation of zone control valves.
3. Flush with clean water, and clean strainers.

B. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Subject piping to hydrostatic test pressure that is not less than 1.5 times the design pressure but not more than 100 psig. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test all electrical controls in accordance with respective installation manuals.

C. Remove and replace malfunctioning radiant heating piping components that do not pass tests, and retest as specified above.

D. Prepare a written report of testing.

3.6 ADJUSTING

A. Balancing Across the Manifold
1. Balance all loops across each manifold for equal flow resistance based on actual loop lengths and total manifold flow.
2. Balancing is unnecessary when all loop lengths across the manifold are within 3 percent of each other in length. Install the supply and return piping to the manifold in a reverse-return configuration to ensure self-balancing.

B. Balancing between manifolds is accomplished with a flow control device installed on the return piping leg from each manifold.

3.7 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace damaged installed products.

C. Clean installed products in accordance with manufacturer's instructions prior to City of New York's acceptance.

D. Remove construction debris from project site and legally dispose of debris.

3.8 DEMONSTRATION

A. Demonstrate operation of hydronic radiant floor heating and cooling system to City of New York's personnel.

3.9 PROTECTION

A. Protect installed work from damage caused by subsequent construction activity on the site.

END OF SECTION 238316

This Page Intentionally Left Blank

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 1 - General Requirements, and shall include all Sections of Division 26 and shall apply to all Work specified, indicated in the Drawings, and as required to furnish a complete installation of mechanical systems for the Project. Review all Sections of the Specifications for related work and coordinate the work of this Section with all other Sections.

B. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes common work results related to all Division 26 Sections.

B. Furnish all labor, services, materials, tools, equipment, appliances, facilities, transportation and incidental work and appurtenances required to furnish a complete and properly operating system.

C. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and shall coordinate the work with that of the other trades to avoid interference. The plans are diagrammatic and show the general arrangement of the conduit, panels, transformers and equipment. All dimensions and existing conditions shall be the responsibility the Contractor. Before proceeding with work check and verify all dimensions.

D. The Contractor shall assume all responsibility for fitting of materials and equipment to other parts of equipment and structure. Make adjustments that may be necessary or as requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation with the applicable trades, existing pipes, conduits and/or ducts.

E. Where the project involves interface with existing building and site systems, the Commissioner has used reasonable care to identify existing utilities and services. The Contractor is responsible to thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available i.e. concealed conditions, which exist in the existing building affected by this work.

F. Documents do not represent to show or list every item to be provided. When an item not shown or listed, is necessary for proper operation of the system and/or equipment, the Contractor shall provide the item which will allow the system to function properly at no increase in Contract Sum.

G. Maintain integrity of fire-rated construction where penetrated by electrical work.

H. Work shall include, but shall not be limited to, the following:
1. Special coordination of chases and plenums.
2. Hoisting and rigging required to complete work of this section.
3. Sleeves, inserts and hangers.
4. Equipment bases and supports.
5. Vibration isolators, and seismic restraints.
6. Motors.
7. Low Voltage Transmission System
8. Interior Lighting System
9. Exterior Lighting System
10. Prime painting.
11. Panelboard and major component identification.
12. Instruction manual and start up instructions.
13. Commissioning.
14. Cleaning.
15. Power wiring to all DDC control panels and controls.

I. Related work specified elsewhere: The following work, unless otherwise noted is not included in this section shall be performed in other sections:
1. Fire Suppression Equipment. Division 21
2. Mechanical Equipment. See Division 23.
3. Automation and Control See Division 23
4. Electronic Safety and Security. Division 28
5. Provision of circuit breakers testing and connections for DDC control power wiring.
6. Gypsum drywall enclosures of supply and return ductwork on all rooftop air handlers, supply and return shafts, as shown on drawings.
7. Excavation and backfill.
8. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment, duct bank envelopes and cast in place manholes and handholes, except as part of an inertia base. See Division 3
9. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal deck.
10. Flashing of wall and roof penetrations.
11. Installation of access panels in floors, walls, furred spaces or above ceilings
12. Outdoor air intake and exhaust louvers.
13. Undercutting of doors and door louvers
14. Partitions and Painting (except as specifically indicated) See Division.
15. Structural supports necessary to distribute loading from equipment to roof or floor, except as specified herein.
16. Foundation drainage systems and site drainage structures.
17. Paving
18. Thermal and sound insulation in partitions and ceilings.

1.3 QUALITY ASSURANCE

A. General:
   1. All equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacture.
   2. All equipment and accessories shall be new and free from defects.
   3. Supply all equipment and accessories in compliance with the applicable standards listed in this Section and with all applicable National, State and Local Codes.
   4. All items of a given type shall be the product of the same manufacturer.
   5. Install work by craftsmen skilled in trade involved and by apprentices as indicated in the general conditions. Rough work will be rejected.
   6. The subcontractor must, within the last three years, prior to the bid opening, have successfully completed in a timely fashion at projects similar in scope and type to the required work.

B. Requirement of regulatory agencies:
   1. In accordance with requirements of Division 1 and as specified herein.
   2. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
   3. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules or regulations, Drawings and Specifications take precedence.
   4. It is not the intent of Drawings and Specifications to repeat requirements of codes except where necessary for completeness or clarity.
   5. If any of the requirements of the above are in conflict with one another, or with the requirements of these specifications, the most stringent requirements shall govern.

C. LEED General Requirements
   1. The Project is targeting a specific level of Certification under USGBC's LEED Green Building Rating System for New Construction. The contractor, subcontractor, vendors, material suppliers and manufactures performing work on the Project shall ensure that the requirements related to these goals, as defined in the sections below, are implemented fully.
   2. Substitutions, or other changes to the work, proposed by the contractor, subcontractor, vendors, material suppliers and manufacturers performing work on this Project shall not be allowed if such changes to this specification section may compromise the attainment of any points under any credits on the Project's LEED Checklist. Green Building Performance Requirements
   3. The Contractor shall implement practices and procedures to meet the Project's GREEN BUILDING requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 01 81 13: "Sustainable Design Requirements", and as specified in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be proposed by the Contractor or their sub-contractors if such changes compromise the stated GREEN BUILDING Performance Criteria.

1.4 APPLICABLE REGULATIONS, CODES, PUBLICATION, PERMITS AND FEES

A. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:
   1. Local and state building, plumbing, mechanical, electrical, fire and health department codes.

2. American National Standards (ANSI).
3. American Society of Testing and Materials (ASTM).
4. Underwriter's Laboratories (UL).
5. National Electric Code (NEC)
6. Insulated Cable Engineers Association (ICEA).
7. Institute of Electrical and Electronic Engineers (IEEE).
8. National Electrical Manufacturers' Association (NEMA).
9. National Electrical Testing Association, Inc (NETA).
10. National Fire Protection Association (NFPA).
11. Occupational Safety and Health Act (OSHA)
12. Certified Ballast Manufacturers (CBM).

B. All materials and equipment shall be listed by Underwriters" Laboratories (UL), and approved by ANSI, ASTM, and NEC for intended service.

C. Most recent editions of applicable specifications and publications of the following organizations form part of these Contract Documents.
1. American National Standards Institute (ANSI)
2. American Society of Testing and Materials (ASTM).
3. Underwriter's Laboratories (UL).
4. National Electric Code (NEC)
5. Insulated Cable Engineers Association (ICEA).
6. Institute of Electrical and Electronic Engineers (IEEE).
7. National Electrical Manufacturers' Association (NEMA).
8. National Electrical Testing Association, Inc (NETA).
9. National Fire Protection Association (NFPA).
10. Occupational Safety and Health Act (OSHA)
11. Certified Ballast Manufacturers (CBM)
12. Illuminating Engineering Society (IES)

D. Specific reference is made to following NFPA codes which contain an exceptionally high quantity of mechanical, electrical, and fire protection requirements.
1. No. 20 - Installation of centrifugal fire pumps.
2. No. 70 - National Electric Code
3. No. 72D - Proprietary Protective Signaling Systems
4. No. 72E - Automatic Fire Detectors

E. Conform to all rules, regulations, standards, ordinances and laws of local, state, and Federal governments and other authorities that have legal jurisdiction over the site.

F. Prior to commencement of work, notify City of New York and applicable authorities as required and submit all of the applicable notifications for construction, operation and demolition. Secure required permits and inspections from any of the authorities having jurisdiction, for this work and pay for all fees required for permits, inspections and review, including special agency construction.

G. Include all utility and local building department charges for providing temporary and permanent electric services to buildings.

H. Provide City of New York, Commissioner and Inspectors from any of the authorities / agencies having jurisdiction access to work at all times.

I. Contractor shall be responsible for all law violations caused by the work under this Division. Notify Contractor in writing when a discrepancy occurs between code requirements and work shown on drawings and resolve matter before proceeding with work.

J. When requirements cited in this specification conflict with each other or with Contract Documents, most stringent shall govern work. Commissioners may relax this requirement when such relaxation does not violate ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.

K. Make corrections in the work as required by the Commissioner or Inspector to pass local regulations.

L. Contractor shall deliver to the Commissioner any and all certificates of inspections, permits, and approvals. Contractor shall submit final inspection certificates signed by governing authorities to the City of New York.

M. Make all necessary submissions to the Department of Environmental Protection, Bureau of Air Resources and Management, and Department of Labor and Industry. Pay all required fees for review, registration and sign off.

1.5 DEFINITIONS

A. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.

B. "Accessible": Ability to perform recommended maintenance without removal of services or equipment and requiring no special platforms.

C. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

D. "Below Grade": Buried in the ground or embedded in concrete slab on ground.

E. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

F. "Exposed": Not installed underground or "concealed."

G. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

H. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

I. "Wiring": Raceway, fittings, wire, boxes and related items.

J. Reference by abbreviation may be made in the specifications and the Contract Drawings for Mechanical and Electrical Work in accordance with the following list:

1. HVAC Heating, Ventilating and Air Conditioning
2. GC Contractor
3. AWG American Wire Gauge
4. USS United States Standards
5. ASTM American Society of Testing Materials
6. ASA American Standards Association
7. AC: Alternating Current.
8. AIC: Ampere Interrupting Capacity.
9. ADA: Americans with Disabilities Act.
10. ANSI: American National Standards Institute.
11. AWG: American Wire Gauge.
12. CBM: Certified Ballast Manufacturers.
13. DC: Direct Current.
14. ETL: Electrical Testing Laboratory.
15. HID: High Intensity Discharge.
16. HP: Horsepower.
17. ICEA: Insulated Cable Engineers Association
18. IEEE: Institute of Electrical and Electronic Engineers.
19. NEMA: National Electrical Manufacturers' Association.
20. NETA: National Electrical Testing Association, Inc.
21. NFPA: National Fire Protection Association.
22. OSHA: Occupational Safety and Health Act.
23. PVC: Polyvinyl chloride.
24. UBC: Uniform Building Code.
25. UL: Underwriters' Laboratories,

1.6 SCOPE

A. Perform work and provide material and equipment as shown on the drawings and/or as specified and/or as indicated in this section of the specifications. Completely coordinate all work of this section with work of other trades and provide a complete and fully functional installation.

B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly require by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for sound, secure and complete installation.

C. Give notices, file plans, obtain permits and licenses, pay fees and back-charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

D. Contractor shall be responsible with obtaining all the final inspection as required by Local Code and ordinances.

1.7 CONTRACT DOCUMENTS

A. Listing of Documents does not limit responsibility of determining full extent of work required by these Contract Documents. Refer to the Commissioner's, Electrical, HVAC, Plumbing and Fire Protection, Structural, Site Utility and all other drawings and other sections that types of and work of other trades with which work of this section must be coordinated.

B. Except where modified by a specific notation to the contrary; it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify coordinated routings and component. The purpose of the document is to indicate systems concept, the main components of the systems, and the approximate geometric relationships. Based on the systems concept, the main components and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational.

E. Information and components shown on riser diagrams, but not shown on plans, and vice versa, shall apply and be provided as if expressly required on both.

F. Data that may be furnished electronically by the Commissioner is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not be substitute for Commissioner's sealed or stamped construction documents.

1.8 COORDINATION DRAWINGS

A. A single set of coordination drawings shall be mutually prepared by all mechanical, electrical, plumbing and fire protection trades.

B. The initiation of these drawings begins with Sheet Metal Subcontractor.

C. The Sheet Metal Subcontractor shall prepare a complete set of electronic background drawings at scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheet metal layout thereon. These will be Coordination Drawings.

D. Each of the mechanical, electrical and other specialty trade shall add its work to these background drawings with appropriate elevations and grid dimensions. Specialty trade information is require for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.

E. Each specialty trade shall sign and date each coordination drawing. Return drawing to the Sheet Metal Subcontractor, who shall route them sequentially to all specialty trades.

F. Where conflicts occur with placement of materials of various trades, the Sheet Metal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by specialty trade. The Sheet Metal Subcontractor shall then final date and sign each drawing. If he cannot resolve conflicts, the decision of the Contractor/Contractor shall be final.

G. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.

H. Sheet Metal Subcontractor shall make prints of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Commissioner/Engineer and have been reviewed and approved.

I. The review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with the other trades, structural and other work.

J. After review:
   1. After review of coordination drawings, the method used to resolve interferences not previously identified shall be as in "MODIFICATIONS IN LAYOUT" above.
   2. All changes to reviewed coordination drawings shall be in writing by the Commissioners/Engineer prior to start of work in affected area.

K. Distribution of Coordination Drawings - The Sheet Metal Subcontractor shall provide the following distribution of documents:
   1. One sepia (reproducible) of each Coordination Drawing to each specialty trade and affected Contractor for their use.
   2. One reproducible of each Coordination drawing to City of New York.
   3. One sepia (reproducible) of each coordination drawing to the Contractor/Contractor.
   4. The above documents can be submitted as electronic media upon agreement of all parties.

L. ALL FIREWALLS AND SMOKE PARTITIONS SHALL BE HIGHLIGHTED ON COORDINATION DRAWINGS FOR APPROPRIATE COORDINATION.

M. The main paths of egress and for equipment removal from main mechanical and electrical rooms must be clearly shown on coordination drawings.

N. Coordination Drawings shall include, but not limited to:
   1. Plumbing systems, piping and equipment.
   2. HVAC piping, systems and equipment.
   3. Control systems.
   4. Electrical distribution, systems and equipment.
   5. Lighting systems and fixtures.
   6. Sheet metal work, components and accessories, costs and boxes in terminals, etc.
   7. Fire protection and sprinkler system, piping and heads.
   8. Structural.
   9. Electrical Equipment Room layouts.
   10. Environmental Rooms and associated refrigeration/heating systems.
   11. Partition/room layout.
   12. Ceiling tile and grid.

13. Access panels.
14. Smoke and fire dampers.
15. Roof drain piping.
16. Major electrical conduit runs, panel-boards, feeder conduit and racks of branch conduit.
17. Above ceiling miscellaneous metal.
18. Heat tracing of piping.
19. Minimum access space requirements for all equipment for both installation and maintenance.

O. Product Selection for Restricted Space: Drawings indicate maximum allowed dimensions for basis of design electrical equipment, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

P. Digital Assets: The contractor shall hand over all digital data files related to the coordination and shop drawing exercise at the end of the construction process, including all, but not limited to the shop drawings, as built conditions and all native digital file formats, including 3D BIM files, if used.

1.9 MODIFICATION IN LAYOUT

A. Electrical, HVAC, Plumbing and Fire Protection Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show exact routings and locations needed to coordinate with structure and other trades to meet the Commissioner's requirements

B. In order to obtain the Commissioner's desired aesthetics in spaces used by building occupants; prior to installation of visible materials, finishes and equipment (including access panels, review Commissioner's Drawings for desired locations and where not definitely indicated, request information from the Commissioner/Commissioner.

C. Check Contract Drawings, as well as Shop Drawings, of all subcontractors to verify and coordinate spaces in which work of this section will be installed

D. Maintain maximum headroom at all locations. All conduit, piping, duct and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components to prevent conflict with work of other trades and to coordinate according to Paragraphs A,B,C,and D above. Systems shall be run in an organized and rectilinear fashion.

F. Where conflicts or potential conflict exists and engineering guidance is desired, submit sketch of proposed resolution to the Commissioner for review and approval

1.10 MEASUREMENTS

A. Contractor shall base all his measurements, both horizontal and vertical from established benchmark. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.11 MATERIALS AND WORKMANSHIP

A. Materials shall be new, meet detailed requirements of the Contract Documents and be identifiable as being specified or substitute products.

B. Materials which do not conform to the requirements of the Contract Documents, are not equal to approved samples or are unsatisfactory or unsuited to the purpose for which they are intended, will be rejected.

C. All work shall be performed in the best and most workmanlike manner by tradesmen skilled in their respective trades and properly licensed.

D. All equipment shall be installed in accordance with the recommendation of the manufacturer.

E. Defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or other cause shall be removed within ten (10) days after written notice is given by the Commissioner and the work shall be re-executed by the Contractor. The fact that the Commissioner may have previously overlooked such defective work shall not constitute total or partial acceptance of it.

F. In no case shall a Bidder base his bid on a class of material or workmanship less than that required by the contract documents nor the governing codes and ordinances.

1.12 CHECKING AND TESTING EQUIPMENT BY CONTRACTORS AND MANUFACTURER'S REPRESENTATIVE

A. All equipment shall be installed in strict accordance with manufacturer's instructions. During construction request supervisory assistance from equipment manufacturer's representatives so the equipment will be correctly installed. After installation, request the Commissioner to inspect and see the equipment is in proper working order.

B. Manufacturer's representative shall review the overall system design relative to the proper application of his equipment in the particular system. He shall note conduit, wiring, control, location, and other relevant relationships, and furnish appurtenances necessary for satisfactory operation.

C. The Contractor's representative shall submit to the CM a signed statement certifying:
   1. The equipment is properly installed and ready for operation
   2. The City of New Yorks maintenance representatives have been thoroughly instructed
   3. Maintenance and operation manuals issued and accepted by the Commissioner.

1.13 TEMPORARY FACILITIES

A. Temporary Light and Power:

B. All temporary facilities shall be removed at completion of project.

1.14 PROJECT COMMUNICATION

A. Communication and Submittals:

B. The specification references communication and submittal of information and documents by the Contractor to the Engineers of Record and CM or visa versa. In all cases such communication shall be submitted to the CM who will review it before forwarding to the relevant party for review and response.

C. If the information provided is not in conformance with the specification the CM shall return it to the relevant Contractor for re-submission.

D. The time taken for this process shall be factored into all work schedules and submissions.

1.15 HOIST, RIGGING, TRANSPORTATION AND SCAFFOLDING

A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for placing all materials and equipment in their proper places in the Project. All temporary work shall be removed from the premises when its use is no longer required.

1.16 GUARANTEE AND 24 HOUR SERVICE

A. Guarantee the Work of this section for one year following the date of Substantial Completion

B. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Commissioner's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

C. In addition to guarantee requirements of Division 1 and of Paragraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in City of New York's name.

D. Replace material and equipment that require excessive service during guarantee period as defined and as directed by the Commissioner.

E. Provide 24 hour service beginning on the date of substantial completion and lasting until the termination of guarantee period. Service shall be at no cost to City of New York

F. Submit copies of equipment and material warranties to Commissioners before final payment.

G. At end of guarantee period, transfer manufacturer's equipment and warranties still in force to City of New York.

H. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of work nor beneficial use by City of New York, and shall not institute guarantee period.

I. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to City of New York's satisfaction, advise the Commissioner in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Commissioners will suggest course of action.

1.17 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify City of New York no fewer than five days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without City of New York's written permission.
3. Comply with NFPA 70E.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment and materials shall be as described in the respective Sections of Division 21, 22,23 and Division 26 and as shown.

2.2 MATERIALS

A. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified. And or/as required to provide a fully operational installation.

B. Equipment, material damaged during transportation, installation, operation is considered as totally damaged. Replace with new. Payment for this equipment shall not be approved. Variance from this permitted only with written acceptance.

C. All items of materials in each category of equipment shall be of one manufacturer.

D. Material and Equipment General Requirements:
1. All equipment and components shall be New.

2. Testing agency labeled or with other identification wherever standards have been established.
3. Commissioner reserves right to reject items not in accordance with Specification either before or after installation.
4. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design.
5. Compatible with space allocated. Modifications necessary to adjust items to space limitations at Contractor's expense.
6. Installed fully operating and without objectionable noise or vibration.

PART 3 - EXECUTION

3.1 SPECIAL RESPONSIBILITIES:

A. Cooperate and coordinate with work of other Sections in executing work of this Section.
1. Perform work such that progress of entire project including work of other Sections shall not be interfered with or delayed.
2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.
3. Obtain detailed installation information from manufacturers of equipment provided under this section.
4. Obtain final roughing dimensions or other information needed for complete installation of items furnished under other Sections or by City of New York.
5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information on proper time, provide cutting and patching or have same done, at own expense and to full satisfaction of Commissioners.
6. Provide information as requested as to sizes, number and locations of pads necessary for floor mounted equipment provided under this Section.
7. Notify Commissioners of location and extent of existing piping, conduit, ductwork and equipment that interferes with new construction. In coordination with and with approval of Commissioners, relocate piping, ductwork and equipment to permit new work to be provided as required by Contract Documents. Remove non-functioning and abandoned piping, ductwork and equipment as directed by Commissioners. Dispose of or store items as requested by Commissioners.

B. Installation Only Items
1. Where this contractor is required to install items which it does not purchase, it shall coordinate delivery and be responsible for their unloading from delivery vehicles and for their safe handling and field storage up to time of installation. This trade shall be responsible for:
2. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt to Commissioner's and structural conditions.
3. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

4. This contractor shall carefully examine such items upon delivery. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of this contractor will be considered only if presented in writing within one week of their date of delivery. Unless such claims have been submitted this contractor shall be fully responsible for the complete reconditioning or replacement of the damaged items.

C. Maintenance of equipment and systems: Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

D. Use of premises: Use of premises shall be restricted as directed by the Commissioner and as required below:
   1. Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of the Commissioner.
   2. Store materials in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets of racks and covered with tarpaulins.
   3. Do not interfere with function of existing sewers and water and gas mains, electrical or mechanical systems and services. Extreme care shall be observed to prevent debris from entering pipe, ductwork and equipment. Confer with the Commissioner as to the disruption of services or other utilities due to testing, connection of new work to existing. Interruption of services shall be performed at time of day or night deemed by City of New York to provide minimal interference with normal operation. Obtain City of New York's approval of the method proposed for minimizing service interruption.

E. Surveys and Measurements:
   1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.
   2. In event of discrepancy between actual measurements and those indicated, notify the Commissioner in writing and do not proceed with work until written instructions have been issued by the Commissioner.

F. Fireproofing:
   1. Clip, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, insofar as possible prior to start of spray fiber work.
   2. Conduit and other items which would interfere with proper application of fireproofing shall be installed after completion of spray fiber work.
   3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be shall be performed by installer of fireproofing and paid for by the trade responsible for damage and shall not constitute grounds for an extra to City of New York.

G. Temporary Utilities:
   1. Refer to Division 1 regarding requirements.
   2. Furnish temporary equipment, and wiring, as needed during the construction phase. Remove temporary items after use.

3.2 MATERIAL AND WORKMANSHIP

A. Work shall be neat and rectilinear. Conduit shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Install material and equipment to comply with manufacturers. Recommended Requirements. Rough Work will be rejected. Work shall be properly and effectively protected, and conduit openings shall be temporarily closed to prevent obstruction and damage before completion.

B. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents.

C. Finish of materials, components and equipment shall be as approved by the Commissioner and shall be resistant to corrosion and weather as necessary.

D. City of New York will not be responsible for material and equipment before testing, commissioning, and acceptance.

3.3 CONTINUITY OF SERVICES

A. Do not interrupt existing services without City of New York's approval.

B. Schedule interruptions in advance, according to City of New York's instructions. Submit, in writing, with request for interruption, methods proposed to minimize length of interruption.

C. Interruptions shall be scheduled at such times of day and work so that they have minimal impact to City of New York's operations.

D. Subcontractor shall coordinate any shutdowns of existing systems as follows:
   1. Give proper notice to City of New York when making shutdowns; a minimum of fourteen full days are required.
   2. Minimize shutdowns of any system.
   3. Provide temporary services where required and perform shutdown and tie-ins at a time convenient to City of New York.
   4. Subcontractor shall be responsible for completing and filing City of New York's shutdown notice questionnaire.
   5. Perform required survey and inspection work required by the notice for shutdown.

E. Include premium time work associated with interruption of services and/or shutdown as necessary to avoid disruption to City of New York's operations.

3.4 ANCHORS AND INSERTS:

A. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation. Insert shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

B. Provide anchors as necessary for attachment of equipment support and hangers.

3.5 CORE DRILLING

A. Core drilling is to be avoided.

B. Set sleeves prior to installation of structure for passage of conduits, etc.

C. Where core drilling is unavoidable, or required by renovation projects, locate all required openings prior to coring and submit to the Commissioner for review.

D. Coordinate openings with Contractor/Contractor and all other trades.

E. Core drilling is to be provided by the Contractor for General Construction and not by the M/E subcontractors.

F. Do not disturb existing systems.

G. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.6 CUTTING AND PATCHING:

A. Complete cutting and patching in accordance with DDC General Conditions, and as follows.

B. Provide all sleeves, core drilling, carpentry, cutting and patching required for proper installation of material and equipment specified in this Division.

C. Do not cut or drill structural members without written approval of Commissioner and structural engineer.

D. No cutting or patching should be done without first receiving the Commissioner's and Structural Engineer's written approval.

E. Any damage caused by cutting and patching shall be restored to the original condition as required by the Commissioner.

3.7 VIBRATION CONTROL:

A. Comply with DDC General Conditions.

B. Design criteria for all the Work of Division 26 shall be as specified in 260548.

3.8 WATERPROOF CONSTRUCTION:

A. Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashing at exterior wall and roof penetrations. Caulk watertight penetrations of foundation walls and floors. Provide membrane clamps at penetrations of waterproof membranes.

B. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rainwater. This requirement applies to damper operators and bearing, damper motors, controls, and

instruments. See other paragraphs in this Division for application of this requirement to panels, motors, and devices.

3.9 RESTORATION OF DAMAGE:

A. Repair or replace, as directed by the Commissioner and/or Commissioner, materials and parts of premises which become damaged as result of installation of Work of this Division. Remove replaced parts from premises.

3.10 ROOF OPENINGS AND CURBS

A. Roof openings where required shall be coordinated with the other affected trades and all flashing and patching shall be as per details indicated on the Commissioner's plans.

3.11 TOOLS AND EQUIPMENT

A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the Work.

3.12 ADJUSTMENTS

A. Preliminary Operation: Operate any portion of installation for City of New York's convenience if so requested by Contractor. Such operation does not constitute acceptance of Work as complete. Cost of utilities, such as gas and electrical power, will be borne by City of New York if City of New York requests operation.

B. Start-up Service: Prior to startup, ensure that systems are ready for their intended use.

C. Start and operate all systems. Provide services of factory trained technicians for startup of major equipment and systems.

D. Adjusting:
1. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.
2. Thereafter, as a result of system operation or as directed by Commissioner, make readjustments as necessary to refine performance and to effect complete system "tune-up".
3. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions for 72 hours continuously and show specified performance.
4. If, in the opinion of the Commissioner, performance of equipment or systems is not in accordance with specifications or submitted data, alter or replace equipment at no increase in Contract Sum. The Contractor, at his option, may order tests from an independent approved laboratory to prove compliance. All such tests shall be at no increase in Contract Sum. Repeat process as often as required. If the reason for unsatisfactory operation is design errors all additional cost for corrective measures will be reimbursed to the contractor.

5. At completion of Work, provide written certification that all systems are functioning properly without defects.

E. Noise:
1. Cooperate in reducing any objectionable noise or vibration caused by electrical systems to the extent of adjustments to specified and installed equipment and appurtenances.
2. Cooperate in adjustment of mechanical systems and terminal devices, as directed by Commissioner, to obtain specified acoustic properties.
3. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no increase in Contract Sum. Includes refinish walls, floors etc.

3.13 INSTALLATION

A. Comply with NECA 1.

B. Coordinate connection of electrical service with utility provider. Comply with utility provider requirements and local codes and regulations.

C. Coordinate connection of branch circuits and feeders to equipment furnished under other Divisions.

D. Assemble equipment required to be field assembled under the direct supervision of the manufacturers' agent. Prior to the final acceptance submit letters from the manufacturers that this has been done.

E. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to the satisfaction of the Commissioner and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.

F. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof mounted equipment shall be installed and supported on structural steel provided under other Sections.

G. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall of ceiling mounting of equipment as required.

H. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.

I. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installations.

J. Structural steel and hardware shall conform to Standard specifications of ASTM; use of steel and hardware shall conform to requirements of Section V of Code of Practice of American Institute of Steel Construction.

K. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly, which will void warrantee. Report in writing to the

Commissioner, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.

L. Measure indicated mounting heights to center of unit for suspended items and wall-mounted items, unless noted otherwise.

M. If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

N. Sequence for efficient flow of installation and positioning prior to building closing-in. Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Provide for ease of disconnecting of equipment with minimum interference to other installations.

O. Arrange raceways, cables, wireways, to be clear of obstructions and of the working and access space of other equipment.

P. Give right of way to piping systems installed at a required slope.

Q. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

R. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Refer to Division 08 Section "Access Doors and Frames."

S. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Comply with Division 07 Section "Penetration Firestopping."

T. Comply with DDC General Conditions; restoration of surfaces disturbed by electrical installation.

3.14 PAINTING

A. Equipment installed shall have shop coat of non-lead paint. Hangers and supports shall have one coat of non-lead primer. Finish painting, including painting of various conduit or wire way systems, shall be done under other Sections.

B. Paint all outside exposed equipment and equipment supports with two coats of weather resistant enamel.

C. Properly prepare Work under this Division to be finish painted.

D. Refer to standard paint colors for all Electrical equipment inside the Building.

E. Paint finished surfaces damaged during electrical installation, matching color and type of paint. Follow manufacturer's written instructions for surface preparation and application. Apply successive coats required to restore finish equal to the unblemished areas.

3.15 FINAL JOBSITE OBSERVATION

A. As the work nears completion, the Contractor is to review the requirements of the Contract Documents, inspect the work and inform all parties involved of the work to be corrected or completed before the project can be deemed substantially complete.

B. The Contractor shall carry out their own final inspection and satisfy the Work.

C. The Commissioner reserves the right to cancel and reschedule the inspection in the event considerable more work remains to be completed or corrected than indicated in the written request for inspection.

D. All items not completed or found not complying with drawings or specifications by the Commissioner will be identified in their inspection report.

E. Correct all items on inspection report. Make the correction and initial and date each item on the report after corrections have been completed.

F. Include the fee for all local inspections.

3.16 INSTRUCTING THE CITY OF NEW YORK

A. Adequately instruct the City Of New York in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the City of New York by Factory Personnel in the care, maintenance, and operation of the equipment and systems.

C. The City of New York has the option to video tape all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:
   1. Maintenance of equipment.
   2. Start-up procedures for all major equipment.
   3. Description of emergency system operation.

END OF SECTION 260500

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2 and 3 control cables.

1.3 DEFINITIONS

A. VFC: Variable frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Divison.

2. Alpha Wire
3. Belden Inc.
4. Encore Wire Corporation.
5. General Cable Technologies Corporation
6. Southwire Incorporated.
7. Tyco Thermal Controls/Pyrotenax System 1850 2-hour fire rated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 or Type XHHW-2.

D. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, and metal-clad cable, Type MC, with ground wire.

E. VFC Cable:

1. Comply with UL 1277, UL 1685, and NFPA 70 for Type TC-ER cable.
2. Type TC-ER with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, and sunlight- and oil-resistant outer PVC jacket.
3. Comply with UL requirements for cables in direct burial applications.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Gardner Bender.
3. Hubbell Power Systems, Inc.
4. Ideal Industries, Inc.
5. Ilsco; a branch of Bardes Corporation.
6. NSi Industries LLC.
7. O-Z/Gedney; a brand of the EGS Electrical Group.
8. 3M; Electrical Markets Division.
9. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 14 AWG and smaller; stranded for No. 12 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exterior Feeders and Branch Circuits: Type XHHW-2, single conductors in raceway.

C. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway Type XHHW-2, single conductors in raceway.

D. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

E. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway and coordinated with Commissioner.

F. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway and coordinated with Commissioner.

J. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

L. VFC Output Circuits: Type XHHW-2 in metal conduit Type TC-ER cable with braided shield.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 Firestops and Smokeseals.

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

This Page Intentionally Left Blank

SECTION 260523

CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Multimode optical-fiber cabling.
2. UTP cabling.
3. RS-485 cabling.
4. Low-voltage control cabling.
5. Control-circuit conductors.
6. Identification products.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

D. RCDD: Registered Communications Distribution Designer.

E. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

B. Painting: Paint plywood on all sides and edges with flat paint.

2.4 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.

3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.5 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Class 1 Control Circuits: Stranded copper, Type XHHW-2, in raceway, complying with UL 44.

C. Class 2 Control Circuits: Stranded copper, Type XHHW-2, in raceway, complying with UL 44.

D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type XHHW-2, in raceway, complying with UL 44.

2.6 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP cables according to TIA-568-C.2.

C. Factory test optical-fiber cables according to TIA-568-C.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Flexible metal conduit shall not be used.

B. Comply with TIA-569-B for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 4 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1 and NFPA 70.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Terminate all conductors and optical fibers; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
3. Cables may not be spliced.
4. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
8. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems" and Ch. 6, "Optical Fiber Structured Cabling Systems." Monitor cable pull tensions.
9. Support: Do not allow cables to lay on removable ceiling tiles.
10. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified for future use with a tag.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-B, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.6 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-A; label printers shall use label stocks, laminating adhesives, and inks complying with UL 969.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 260523

This Page Intentionally Left Blank

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes: Grounding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.

B. Qualification Data: For qualified testing agency and testing agency's field supervisor.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells, grounding connections for separately derived systems based on NFPA 70B.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary,

install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

G. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.5 LABELING

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Commissioner promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

This Page Intentionally Left Blank

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Provide supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Provide equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps .

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Comply with requirements in for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

This Page Intentionally Left Blank

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Metal wireways and auxiliary gutters.
3. Boxes, enclosures, and cabinets.
4. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing

B. ENT: Electrical nonmetallic tubing

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

J. RMC: Rigid metal conduit.

K. RGS: Rigid galvanized steel conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Qualification Data: For professional engineer.

C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch , minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel or aluminum.

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel.
b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Technologies Company; Cooper Crouse-Hinds.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. FSR Inc.
5. Hoffman; a Pentair company.
6. Hubbell Incorporated; Killark Division.
7. Kraloy.
8. Milbank Manufacturing Co.

9. Mono-Systems, Inc.
10. O-Z/Gedney; a brand of EGS Electrical Group.
11. RACO; a Hubbell Company.
12. Robroy Industries.
13. Spring City Electrical Manufacturing Company.
14. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
15. Thomas & Betts Corporation.
16. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

J. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

K. Modular Gangable boxes are prohibited, use non-modular boxes sized for number of ganged devices.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. CDR Systems Corporation; Hubbell Power Systems.
   d. NewBasis.
   e. Oldcastle Precast, Inc.; Christy Concrete Products.
   f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
   g. Or approved equal

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: Rigid Steel Conduit.
2. Concealed Conduit, Aboveground: IMC EMT.
3. Underground Conduit: RNC, Type EPC-80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units Heavy-duty fiberglass units with polymer-concrete frame and cover, SCTE 77, Tier 8 structural load rating.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid Steel conduit. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit IMC.

7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway EMT.
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway Riser-type, optical fiber/communications cable raceway Plenum-type, optical fiber/communications cable raceway EMT.

9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Commissioner for each specific location.

J. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet . Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install handholes with bottom below frost line, below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Warning tape.
4. Warning planks.

1.4 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

C. Qualification Data: For professional engineer and testing agency.

D. Source quality-control test reports.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

1.7 COORDINATION

A. Coordinate layout and installation of ducts with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Commissioner.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80-PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type DB-60-PVC, in direct-buried duct bank, unless otherwise indicated.

3.2 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329300 "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to DDC General Conditions.

3.3 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

9. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Section 312000 "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

10. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.4 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.6 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

SECTION 260544

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by the following provide products by one of the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.4 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

This Page Intentionally Left Blank

SECTION 260548

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Work Specified Elsewhere:

1. Division 1 – Definitions and requirements for Acoustically Sensitive Rooms (ASR), Noise Producing Rooms (NPR), Acoustically Isolated Construction (AIC:
   a. Division 26 – Requirements for resilient penetration detailing:
   b. Division 7 – Acoustical Sealant
   c. Division 3 – Housekeeping pads and bases (Cast-in-Place Concrete)
   d. Division 26 – Installation of Transformers
   e. Division 26 – Performance Lighting System
   f. Division 26 – Electric Service

1.2 SUMMARY

A. For the purposes of this specification, an Isolator is considered to be any equipment used for the resilient support of mechanical, plumbing, and fire-protection systems equipment including bases, roof-curb rails, hangers, and mounts.

B. This Section includes the following:

1. Vibration isolation concrete inertia bases
2. Elastomeric and spring isolation for base-mounted support
3. Elastomeric and spring isolation for hanging supports
4. Elastomeric isolation for fittings
5. Isolation pads.
6. Spring isolators.
7. Restrained spring isolators.
8. Channel support systems.
9. Restraint cables.
10. Hanger rod stiffeners.
11. Anchorage bushings and washers.

C. Related Sections include the following:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

D. Vibration isolator sizes and layout shall be determined by the vibration isolator supplier, accounting for the possible non-uniform weight distribution of the equipment. Supplier's selection shall comply with the vibration isolation equipment composition and type, material durometer and/or static deflection as specified herein. Supplier's recommendations for alternate equipment shall be presented in writing to the Commissioner.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

A. Design vibration isolation mounts and hangers to support equipment and conduit at their full operating loads.

B. Design seismic restraints to provide sufficient restraint in accordance with all applicable codes and standards.

C. Design vibration isolation mounts to achieve the minimum static deflection specified in this section.

1.5 ACTION SUBMITTALS

A. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

B. Submit a vibration isolation system schedule indicating the following:

1. Manufacturer, type, model number, size
2. Height when uncompressed and static deflection of each isolation element
3. The additional deflection to solid under actual loads.
4. The ratio of spring height under actual load to spring diameter
5. Spring constant of each isolation element
6. Estimated imposed load on each isolation element
7. Spring outer diameter, free operating, and solid heights

C. Product Data: For the following:

1. The model number and corresponding specification classification
2. Dimensions (uncompressed)
3. Load vs. deflection curves or tables
4. Rated load capacity and rated deflection and over load capacity

5. For products which are not listed as approved manufacturers and products, submittals shall include the information required above, plus the following information:
6. Samples of all acoustic isolation products. After approval, samples will be returned for installation at the job. All costs associated with submission of samples shall be borne by the Contractor.
7. Corporate information indicating that the manufacturer has been in business for at least three continuous years and has provided acoustic isolation products on projects of similar scope.
8. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    a. Annotate to indicate application of each product submitted and compliance with requirements.

9. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

1.6 INFORMATIONAL SUBMITTALS

A. Shop Drawings:
1. Signed and sealed by a qualified professional engineer.
2. Submit shop drawings indicating scope of vibration isolation work and locations of units and flexible connections. Include support isolation points for piping and ductwork including risers, air housing and inertia bases. Drawings shall include clear, coordinated reference to the submitted product data.
3. For bases and curbs, drawings shall include:
4. Design calculations for selecting isolation products and sizes and designing bases. Include the total weight and load distribution of the supported equipment.
5. Dimensioned detail drawings of bases including the location of isolators, the method of attachment to structure, and the method of attachment to the supported equipment.
6. For hangers and supports, drawings shall include:
    a. Layout of isolator hangers, mounts, and other elements shown on an outline of the isolated equipment, including complete details of attachment to load-bearing structure or supplementary framing.
7. For pneumatic vibration isolators: provide certification of equipment load, natural frequency, and damping based on laboratory tests performed by an independent laboratory.
8. Piping isolators shown and identified on piping layout drawings.
9. Provide seismic restraint calculations, certified by a qualified Professional Engineer, as appropriate to project requirements.

B. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. CDM Novitec (CDM), Evanston, IL – www.cdm-novitec.com
5. Isolation Technology, Inc.
6. Kinetics Noise Control.
7. Mason Industries.
8. Vibration Eliminator Co., Inc.
9. Vibration Isolation.
10. Vibration Mountings & Controls, Inc.

B. Pads : Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Isolator Selection:

1. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer but subject to minimum requirements indicated herein and in the schedule on the drawings.
2. Vibration isolator sizes and layout shall be determined by the vibration isolator supplier.
3. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness, shall not differ from the design objectives for the equipment as a whole by more than ±10%.
4. Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
7. Each spring isolator shall be designed and installed so that the ends of the spring remain parallel during and after the spring installation.
8. Spring isolators shall operate in the linear portion of their load versus deflection curve.
9. Springs shall be sized to be non-resonant with equipment forcing frequencies or support structure natural frequencies.

E. Neoprene Isolators:

1. Neoprene isolators shall comply with ASTM D2240 and be oil resistant neoprene.
2. Neoprene Isolators shall have a Shore hardness of 30 to 60 ±5, as specified herein, after minimum aging of 20 days or corresponding over-aging
3. Neoprene Isolators shall have a straight-line deflection curve over a deflection range of not less than 50% above the design deflection.

F. Exterior applications:

1. All isolators protected from the outdoor elements shall utilize neoprene of bridge bearing quality. All isolators exposed to the outdoor elements shall utilize natural rubber with a durometer as specified herein.
2. All isolators that are to be installed outdoors or exposed to the weather shall be hot-dipped galvanized and shall be furnished with neoprene mounting washers and bushings for hold-down bolts to prevent any metal to metal contact.

G. Identification:

1. Provide isolators with visible color identification or other mark to indicate capacity range.
2. All vibration isolators shall have either known undeflected heights or calibration markings so that, after adjustment, the amount of deflection can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

H. Bases

	Mason	Kinetics	CDM	VMC
Type 1	WFSLFSW Base	SFB Base	CDM-ISO-MACHINE-FLOAT	as approved
Type 2	KSLFSW Base	CIB Base	CDM-ISO-	MPF Base

			MACHINE-FLOAT	

1. Type 1 Base

Type 1 base shall be a structural steel frame with clearance holes located to correspond to the mounting bolt holes of the equipment mounted on the base. A minimum 1 inch clearance shall be provided between the base and the supporting structural slab.

Bases shall have built-in motor slide rails, and shall be reinforced as necessary to withstand belt pull without drive misalignment or base distortion. The bases shall be constructed with deep angle steel sections with a minimum vertical angle leg of 4 inches (100mm) for motors of 7.5 hp (5.6 kW) or less, 5 inches (125mm) for motors between 7.5 hp (5.6 kW) and 20 hp (14.9 kW), and 6 inches (150mm) for motors over 20 hp (14.9 kW).

2. Type 2 Base

a. Type 2 base shall consist of an integral rectangular structural steel form into which concrete is poured. Perimeter members shall be beams of depth equal to 10% of the longest span of the base, but not more than 12 inches (300mm) nor less than 6 inches (150mm) deep. Forms shall include motor slide base and all reinforcing steel. Where anchor bolt locations fall in concrete, the reinforcing steel shall include drilled members with sleeves welded below the steel to accept the anchor bolts. Height saving steel brackets shall be used in all mounting locations. A minimum 1 inch (25mm) clearance shall be provided between the base and the supporting structural slab.

When the concrete base is "T" shaped, isolators shall be located under the projections as well as under the main body in order to prevent cantilever distortion.

Thickness of concrete within inertia base shall be as follows:

Motor Size	Minimum Thickness of Inertia Base
5 to 20 Horsepower	6 inches
25 to 50 Horsepower	8 inches
60 to 100 Horsepower	10 inches
Greater than 100 Horsepower	12 inches

I. Curbs

	Mason	Kinetics	CDM	VMC
Type 1	CMAB Curb	ESR Curb	as approved	AXR Spring-Flex Base
Type 2	RSC Curb	ESSR Curb	as approved	P6200 or P6300 Curb

1. Type 1 Curb

a. Type 1 curb for roof-mounted equipment shall be a structural steel or aluminum base mounted directly to the structure or roof curb with an isolated upper section supported on steel springs. The upper frame must provide continuous support for the equipment.

b. Wind resistance shall be provided by resilient snubbers at the corners of the base.

c. Weatherproofing shall be provided by a continuous flexible seal. All springs shall have removable waterproof covers to allow for adjustment or replacement of the springs.

2. Type 2 Curb

a. Type 2 curb for roof-mounted equipment shall be a structural steel base mounted directly to the structure with an isolated upper section supported on steel springs. The upper frame must provide continuous support for the equipment. Steel springs shall rest on 1/4" (6mm) min. thickness neoprene pads.

b. Wind resistance shall be provided by resilient snubbers at the corners of the base. All-directional snubber bushings shall be 1/4" (6mm) minimum thickness neoprene. All hardware must be plated or galvanized to provide a rust-resistant finish.

c. Weatherproofing shall be provided by a continuous flexible seal. All springs shall have removable waterproof covers to allow for adjustment or replacement of the springs.

J. Mounts

	Mason	Kinetics	CDM	VMC
Type 1	W Pad	NP Pad	CDM-ISO-MACHINE-FIX	SHEAR-FLEX Pad
Type 2	Super W Pad	NGS/NGD Pad	CDM-ISO-MACHINE-FIX	Maxi-Flex Pads
Type 3	ND Mount	RD Mount	CDM-ISO-MACHINE-FIX	RD Mount
Type 4	SLF Mount	FDS Mount	CDM-ISO-MACHINE-FIX	AC or ADC Mount
Type 5	SLR Mount	FLS Mount	CDM-ISO-MACHINE-FIX	AWRS Mount

1. Type 1 Mount

a. Type 1 mount shall be a minimum 5/16 inch (8mm) thick neoprene pad ribbed or waffled on both sides. The pads shall be manufactured with bridge bearing quality neoprene, and selected for a maximum durometer of 50 and designed for strain of 10 to 15% of the pad thickness, but shall not exceed the rated maximum strain of the pad. If the isolated equipment does not load the pad uniformly over its entire area, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.

b. Type 1 mounts shall consist of two or more 5/16 inch (8mm) thick ribbed or waffle neoprene pads sandwiching a 16 gauge stainless steel shim plate when greater thickness or multiple layers are indicated on contract documents.

c. If the isolator is bolted to the structure, a neoprene vibration isolation washer and bushing shall be installed under the bolt head between the steel washer and the base plate.

2. Type 2 Mount

   a. Type 2 mounts shall be pads manufactured of neoprene or encapsulated glass fiber.
   b. Materials:

      i Neoprene isolation mounts shall be ¾" (19mm) thick neoprene pads waffled on both sides. The pads shall be manufactured with bridge bearing quality neoprene, and selected for a maximum durometer of 50 and designed for strain of 10 to 15% pad thickness. Where required, steel load-spreading plates shall be incorporated between the equipment and the Neoprene Isolation Pad.
      ii Glass fiber isolation mounts shall consist of high density molded glass fiber pads individually coated with a flexible elastomeric membrane. Pads shall be manufactured from annealed glass fibers stabilized by precompression during manufacture. The deflection of the pad while under load shall range from 10 to 15% of the pad thickness, but shall not exceed the rated maximum strain of the pad.

   c. If the isolator is bolted to the structure, a neoprene vibration isolation washer and bushing shall be installed under the bolt head between the steel washer and the base plate.

3. Type 3 Mount

   a. Type 3 mounts shall be laterally stable, double deflecting, molded neoprene isolators. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed and bolt holes shall be provided in the base. The mounts shall have leveling bolts rigidly secured to the equipment.
   b. The isolator shall be manufactured with bridge bearing quality neoprene, and selected for a maximum durometer of 50 and designed for strain of 10 to 15% of the pad thickness, but shall not exceed the rated maximum strain of the pad.

4. Type 4 Mount

   a. Type 4 mounts shall have a free-standing and laterally stable steel spring without any housing. Springs shall be designed so that the ratio of the horizontal to vertical spring constant is between one and two.
   b. A minimum 1/4 inch (6mm) thick neoprene pad shall be bonded to the isolator baseplate.
   c. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, a neoprene vibration isolation washer and bushing shall be installed under the bolt head between the steel washer and the base plate.

5. Type 5 Mount

   a. Type 5 mounts shall be a spring and neoprene mount that incorporates a housing which includes vertical limit stops to prevent spring expansion when weight (water or other fluid) is removed from the equipment and limits the movement of equipment when it is subjected to wind loading.

b. A minimum clearance of 1/2 inch (12 mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring operation. Limit stops shall be out of contact with equipment during normal operation, start up and shut down. A neoprene washer shall be installed beneath the bolt head / washer used to restrain the isolator.

c. In outdoor rooftop installations isolators must be bolted to the roof or supporting structure with a neoprene mounting sleeve.

d. Where seismic code requirements dictate the use of a restraining mechanism, Type 5 mounts shall be utilized beneath equipment identified to be mounted on Type 4 mounts.

K. All Directional Captive Mounting

	Mason	Kinetics	CDM	VMC
Captive Mount	BR	RQ	CDM-ISO-MACHINE-FIX	as approved

1. Captive Neoprene elements shall be arranged in opposition within a steel or ductile iron housing to provide positive mechanical restraint in all directions. Neoprene elements shall prevent metal-to-metal contact during normal operation. Bonded assemblies without mechanical interlocks are not acceptable.

2. Static deflection shall be chosen based on the direction of mounting (tension, compression, or shear) and as specified.

L. Hangers

	Mason	Kinetics	CDM	VMC
Type 1	not used			
Type 2	not used			
Type 3	HD or WHD Hanger	RH Hanger	As approved	RHD Hanger
Type 4	30N or W30N Hanger	Type SRH Hanger	As approved	RSH-30A Hanger

1. Type 1 Hanger (not used)

2. Type 2 Hanger (not used)

3. Type 3 Hanger

a. Type 3 hangers shall consist of a molded neoprene or encapsulated glass fiber isolating element in a steel hanger box. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch (19mm) larger than the diameter of the hanger rod, or an alternative design approach shall be incorporated to permit the hanger rod to swing through a 30 degree arc without defeating the vibration isolation effectiveness of the hanger.

b. The isolator shall be manufactured with bridge bearing quality neoprene, and selected for a maximum durometer of 50 and 10% to 15% strain.

4. Type 4 Hanger

a. Type 4 hangers shall consist of a steel spring in series with a neoprene or encapsulated glass fiber isolating element. The neoprene element shall have a strain not exceeding 15%.

b. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. A neoprene sleeve shall be provided where the lower hanger rod passes through the steel hanger box, or an alternative design approach shall be incorporated, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch (19mm) larger than the diameter of the hanger rod.

M. Neoprene Mounting Washers and Bushings

1. Neoprene mounting sleeves for hold-down applications of equipment with vibration isolators shall be:

	Mason	Kinetics	CDM	VMC
Washer	HLW	as approved	as approved	as approved
Bushing	HLB	as approved	as approved	as approved

N. Flexible Piping Connections

	Mason	Kinetics	CDM	VMC
Spherical Rubber	Safeflex Series	Kinflex Series	As approved	VM-series
Braided Metal	BBS or BBF	Kinflex series	as approved	as approved

1. Flexible spherical rubber expansion fittings:

a. EPDM rubber impregnated liner with solid steel constraining ring.

b. Control rods or cables shall not be used to connect across flexible pipe connectors. Pipes shall be supported or hung using isolators specified herein.

2. Braided metal hoses

a. Corrugated hose body surrounded by metallic braided hose

3. Expansion fittings shall be selected by the manufacturer based on movement and pressure rating.

O. Flexible Neoprene Fitting Isolator

	Spring City Electric	OZ/Gedney
Flexible Neoprene Fitting	Type DF	Type DX

1. Flexible Neoprene Fitting isolator shall consist of threaded metal fittings on both ends of a neoprene sleeve to create a resilient fitting for the connection of electrical conduits and allow for acoustic isolation, expansion and deflection.

2. A flexible grounding strap shall be provided to maintain electrical continuity between isolated conduits.

3. Neoprene shall be bridge-bearing quality with a maximum durometer of 50.

P. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Following the installation of isolated conduits, resilient penetrations or other isolated electrical equipment and prior to architectural enclosure of these items, the electrical contractor shall notify the Commissioner of the completion of installation so an inspection of the work can occur prior to architectural enclosure of the work.

3.3 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.4 INSTALLATION

A. Resilient Support Of Wiring and Conduit Connected To Isolated Equipment

1. All wiring connections to mechanical equipment on isolators shall be made with a minimum 18-inch (45 cm) long flexible conduit in a "U" shaped loop.

2. In limited spaces where other means of conduit isolation may not fit or where conduit is buried within slabs at the crossing of the Extent of AIC, install a flexible neoprene fiting.

3. No wiring or conduit shall be supported from other pipes, ducts, or equipment.

4. Resiliently isolated conduit shall not contact the building construction or other equipment.

5. Parallel running conduit may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the largest determined by the provisions for conduit isolation. Do not mix isolated and non-isolated conduit on the same trapeze.

6. Conduit shall be supported on Type 4 isolators under the following conditions:
   a. Ducts and pipes within the Mechanical Equipment Room that are connected to equipment that is vibration isolated with spring-type isolators.

b. Ducts and pipes within the Mechanical Equipment Room but still within 30 feet from connection to equipment that is vibration isolated with spring-type isolators.
c. This includes ducts, domestic water, heating, compressed air, hydraulic fluid, steam and chilled water pipes etc. The only exclusions are roof and floor drains and sprinkler piping.
d. The first isolator both upstream and downstream of equipment on springs shall have a static deflection equal to 1.5 times that of the equipment isolators, up to a maximum of 2 inches. The static deflection of the remaining pipe isolators within the Mechanical Equipment Room or within 30 feet of the equipment or within 50 pipe diameters of the equipment(whichever distance is greater) shall be 1 inch(25mm). .

7. Conduit shall be supported on Type 3 isolators under the following conditions:
   a. Ducts and pipes within the Mechanical equipment room that are connected equipment this is vibration isolated with neoprene-type isolators.
   b. Ducts and pipes beyond the Mechanical Equipment Room but still within 30 feet from connection to equipment that is vibration isolated with neoprene-type isolators.

8. Conduit with Multiple Connections
   a. Where a pipe run connects multiple items of equipment in the mechanical room the pipe mounts or hangers for the entire run shall be chosen to suit the connected equipment of greatest static deflection.

B. Resilient Support Of Conduit At Special Construction

1. All building services that cross the extent of AIC shall be suspended or mounted on vibration isolators for a distance of 8 feet measured linearly along the penetrating element.

C. Flexible Connectors

1. All wiring connections to mechanical, electrical, and plumbing equipment supported on vibration isolators shall be made with the following:
   a. For equipment supported on Type 2 or 3(neoprene-type) isolators, provide a 36 inch(1m) long slack U-shaped flexible conduit or a minimum 36 inch(1m) long flexible conduit in a 360 degree loop. Flexible conduit and cable shall be capable of and recommended for a greater curvature than what is installed.
   b. For equipment supported on a Type 4 or 5(spring-type) isolators, provide a minimum 36 inch (1m) long flexible conduit in a 360 degree loop. Flexible conduit and cable shall be capable of and recommended for a greater curvature than what is installed.

2. A neoprene flexible hose shall be installed to connect a conduit on mounts or hangers to a piece of equipment on mounts or hangers of less static deflection than the pipe.
   a. Install expansion joints of neoprene or EPDM as connections to equipment that is supported from vibration isolation.
   b. Where neoprene rubber or EPDM mounts are not approved, provide two metal bellows or flexible metal hoses at 90-degree orientation to each other.

3. In limited spaces where other means of conduit isolation may not fit or where conduit is buried within slabs at the crossing of the Extent of AIC, install a flexible neoprene fitting.

D. Resilient Support of Electrical Equipment

1. The table below summarizes the vibration isolation requirements for all equipment.

2. All equipment located in Mechanical Rooms with floating floors can be installed without any additional floor isolation. All requirements for ceiling-supported equipment, resilient connections, and penetrations still apply.

	On Grade			Above Grade		
Equipment Type	Base[1]	Isolator	Defl.	Base[1]	Isolator	Defl.
Transformers						
45KVA or less	1	3	0.3"	1	3	0.3"
45KVA to 750KVA	1	3	0.3"	1	4	1"
750KVA or greater	2	3	1"	2	4	1"
Emergency Generators	--	3	0.3"	--	5	2"
Motor Control Centers	1	1 or 3	0.3"	1	1 or 3	0.3"
Enclosures containing relays, transformers, ballasts, or choke coils	1	3 or Captive Neoprene Mounting	0.3"	1	3 or Captive Neoprene Mounting	0.3"

3. If equipment can be supported by point loads, base type 1 may not be required. Coordinate with equipment manufacturer to confirm the need for a base.

4. Dimmer racks shall be located a minimum of three inches from adjacent walls.

3.5 Demonstration

A. The vibration isolation manufacturer shall inspect and approve the installation of the vibration isolators, and shall submit a report to the Commissioner which verifies that all of the isolators for electrical equipment has been properly installed and that the installation is in full conformance with the specification. The report shall contain the type and measured static deflection of any spring isolators provided.

B. Upon completing installation and adjustment for suitable operation of all work specified under this section, the Contractor shall notify in writing the Commissioner, who will schedule an inspection by the Commissioner. The letter shall certify that all work specified under this section is complete, operational and adjusted in every respect, and that all work is ready for the completion checkout. Defective equipment and installation shall be repaired at the cost of the Contractor, and another inspection shall be scheduled.

C. For each inspection, workmen shall be furnished to perform such functions as are necessary for inspection of the equipment.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with City of New York, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.7 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

This Page Intentionally Left Blank

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. Legend: Indicate voltage and system or service type.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Colors for Cables Carrying Circuits at 600 V and Less:
1. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.4 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.

2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trenchexceeds 16 inches overall.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below.
   a. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral: White
      5) Ground: Green

   b. Colors for 480/277-V Circuits:

      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral: Grey
      5) Ground: Green

D. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive, self-laminating polyester labels with the conductor designation.

H. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchgear.
   e. Switchboards.
   f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   g. Substations.
   h. Emergency system boxes and enclosures.
   i. Motor-control centers.
   j. Enclosed switches.
   k. Enclosed circuit breakers.
   l. Enclosed controllers.
   m. Variable-speed controllers.
   n. Push-button stations.
   o. Power transfer equipment.
   p. Contactors.
   q. Remote-controlled switches, dimmer modules, and control devices.
   r. Battery-inverter units.
   s. Battery racks.
   t. Power-generating units.
   u. Monitoring and control equipment.

v. UPS equipment.

END OF SECTION 260553

SECTION 260573

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals may be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.
3. Coordination-Study Report.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For coordination-study specialist.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following or approved equal:
1. SKM Systems Analysis, Inc.
2. ETAP Star
3. Basler

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other electrical Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:

    a. Circuit-breaker and fuse-current ratings and types.
    b. Relays and associated power and current transformer ratings and ratios.
    c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    d. Generator kilovolt amperes, size, voltage, and source impedance.
    e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    f. Busway ampacity and impedance.
    g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus.
2. Motor-control center.
3. Distribution panelboard.
4. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.

1. Transformers:

a. ANSI C57.12.10.
b. ANSI C57.12.22.
c. ANSI C57.12.40.
d. IEEE C57.12.00.
e. IEEE C57.96.

2. Medium-Voltage Circuit Breakers: IEEE C37.010.
3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
4. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

B. Comply with IEEE 241 IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:

a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

G. Completed data sheets for setting of overcurrent protective devices.

END OF SECTION 260573

SECTION 260923

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Leviton Mfg. Company Inc.
3. NSi Industries LLC; TORK Products.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Rating: 20-A ballast load, 120-/240-V ac.
3. Programs: 10 channels; each channel is individually programmable with eight on-off set points on a 24-hour schedule.
4. Astronomic Time: Selected channels.
5. Automatic daylight savings time changeover.
6. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.

B. Description: Solid state, with SPST DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc(to be verified by Lighting Designer) , with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Lutron Electronics Co., Inc.
   2. Sensor Switch, Inc.
   3. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
   3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
   4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
   5. Mounting:

      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
      c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

   6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
   7. Bypass Switch: Override the "on" function in case of sensor failure.
   8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

   1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
   2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
   3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .

   1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lutron Electronics Co., Inc.
2. Sensor Switch, Inc.
3. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

2.5 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.

4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

1. Monitoring: On-off status,.
2. Control: On-off operation,.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller thanNo. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

C. Install and aim sensors so that they are not triggered by movement in adjacent spaces.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit City of New York's operations.
2. For daylighting controls, adjust set points and deadband controls to suit City of New York's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.23 "Relay-Based Lighting Controls."

B. Instruct City of New York's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

This Page Intentionally Left Blank

SECTION 260943.23

RELAY-BASED LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes: Lighting control panels using mechanically held relays for switching.

B. Section Includes: Networked lighting control panels using control-voltage relays for switching and that are interoperable with BAS.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. IP: Internet protocol.

C. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

D. PC: Personal computer; sometimes plural as "PCs."

E. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each relay panel and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail wiring partition configuration, current, and voltage ratings.
4. Short-circuit current rating of relays.
5. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol.

B. Qualification Data: For testing agency.

C. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lighting Control Relays: Equal to 20 percent of amount installed for each size indicated.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with UL 916.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Lighting control panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified."

B. BAS Interface: Provide hardware and software to enable the BAS to monitor, control, display, and record data for use in processing reports.

1. Hardwired Points:

a. Monitoring: On-off status.
b. Control: On-off operation.

2. Communication Interface: Comply with ASHRAE 135. The communication interface shall enable the BAS operator to remotely control and monitor lighting from a BAS operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS.

2.3 LIGHTING CONTROL RELAY PANELS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acuity Brands, Inc., Lighting Control & Design, Inc.; GR2400.
2. Leviton Mfg. Company Inc.; Z-Max Plus.
3. WattStopper, a Legrand Group brand; Lighting Integrator.

B. Description: Standalone lighting control panel using mechanically latched relays to control lighting and appliances.

C. Lighting Control Panel:

1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
2. A vertical barrier separating branch circuits from control wiring.

D. Control Unit: Contain the power supply and electronic control for operating and monitoring individual relays.

1. Timing Unit:

   a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
   b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
   c. Four independent schedules, each having 24 time periods.
   d. Schedule periods settable to the minute.
   e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
   f. 10 special date periods.

2. Sequencing Control with Override:

   a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
   b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
   c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
   d. Override control "blink warning" shall warn occupants approximately five minutes before actuating the off sequence.

3. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.

E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA. Control shall be three-wire, 24-V ac.

F. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be three-wire, 24-V ac.

G. Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.

H. Operator Interface:

1. Integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming.
2. Log and display relay on-time.
3. Connect relays to one or more time and sequencing schemes.

2.4 NETWORKED LIGHTING CONTROL PANELS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acuity Brands, Inc., Lighting Control & Design, Inc.; GR2400.
2. Leviton Mfg. Company Inc.; Z-Max Plus.
3. WattStopper, a Legrand Group brand; Lighting Integrator.

B. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.

C. Lighting Control Panels:

1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
2. A vertical barrier separating branch circuits from control wiring.

D. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.

1. Ethernet Communications: Comply with MS Windows TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
2. Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via BAS RS-485 serial networks and Ethernet 10Base-T networks as a native device.
3. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.

    a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
    b. Panel summary showing the master and slave panels connected to the controller.
    c. Controller diagnostic information.
    d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.

4. Timing Unit:

    a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
    b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
    c. Four independent schedules, each having 24 time periods.
    d. Schedule periods settable to the minute.
    e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
    f. 16 special date periods.

5. Time Synchronization: The timing unit shall be updated not less than every 12 hour(s) with the network time server.
6. Sequencing Control with Override:

    a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
    b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
    c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
    d. Override control "blinking warning" shall warn occupants approximately five minutes before actuating the off sequence.
    e. Activity log, storing previous relay operation, including the time and cause of the change of status.
    f. Download firmware to the latest version offered by manufacturer.

E. Standard Control Unit, Installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916.

1. Electronic control for operating and monitoring individual relays, and display relay on-time.
2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
3. Integral keypad and digital-display front panel for local setup, including the following:

    a. Blink notice, time adjustable from software.
    b. Ability to log and display relay on-time.
    c. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.

F. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA. Control shall be three-wire, 24-V ac.

G. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-

mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.

H. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and instruction of City of New York's personnel. That device shall remain the property of City of New York.

I. Software:

1. Menu-driven data entry.
2. Online and offline programming and editing.
3. Provide for entry of the room or space designation for the load side of each relay.
4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
5. Size the software appropriate to the system.

2.5 MANUAL SWITCHES AND PLATES

A. Push-Button Switches: Modular, momentary contact, three wire, for operating one or more relays and to override automatic controls.

1. Match color and style specified in Section 262726 "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.
3. Internal white LED locator light to illuminate when circuit is off.

B. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."

C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.6 FIELD-MOUNTED SIGNAL SOURCES

A. Indoor Occupancy Sensors: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

B. Outdoor/Indoor Photoelectric Switches

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6 for horizontal copper cable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panels according to NECA 407.

B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

A. Comply with NECA 1.

B. Install panels and accessories according to NECA 407.

C. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

D. Mount top of trim 90 inches above finished floor unless otherwise indicated.

E. Mount panel cabinet plumb and rigid without distortion of box.

F. Install filler plates in unused spaces.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Create a directory to indicate loads served by each relay; incorporate City of New York's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Acceptance Testing Preparation:

1. Test continuity of each circuit.

D. Lighting control panel will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for one year.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within one year from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow City of New York to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

A. Instruct City of New York's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION 260943.23

SECTION 262200

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.8 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Products.
2. General Electric Company.
3. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Enclosure: Ventilated, NEMA 250, Type 3R.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

F. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: Gray.

G. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

H. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

I. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

J. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.
2. Tested according to NEMA TP 2.

K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
2. Indicate value of K-factor on transformer nameplate.

L. Wall Brackets: Manufacturer's standard brackets.

M. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413

SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.

4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.10 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

1.11 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

    1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    3. Square D; a brand of Schneider Electric.

B. Front-Connected, Front-Accessible Switchboards:

    1. Main Devices: Panel mounted.
    2. Branch Devices: Panel mounted.

3. Sections front and rear aligned.

C. Nominal System Voltage: as indicated on drawings.

D. Main-Bus Continuous: as indicated on drawings.

E. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

F. Indoor Enclosures: Steel, NEMA 250, Type 1.

G. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

H. Barriers: Between adjacent switchboard sections.

I. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.

J. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

K. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks.Include potential transformers having primary and secondary fuses with disconnecting means and secondary wiring terminated on terminal blocks.

L. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

M. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

N. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. solation Barrier Access Provisions: Permit checking of bus-bolt tightness.

O. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.
4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

B. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.
2. Two-step, stored-energy closing.

3. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time time adjustments.
   c. Ground-fault pickup level, time delay, and I^2t response.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

D. Fuses are specified in Section 262813 "Fuses."

2.3 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
   1. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; type; secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
   2. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
   3. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

   1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

      a. Phase Currents, Each Phase: Plus or minus 1 percent.
      b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
      c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
      d. Megawatts: Plus or minus 2 percent.
      e. Megavars: Plus or minus 2 percent.
      f. Power Factor: Plus or minus 2 percent.
      g. Frequency: Plus or minus 0.5 percent.
      h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
      i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
      j. Contact devices to operate remote impulse-totalizing demand meter.

   2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Impulse-Totalizing Demand Meter:

   1. Comply with ANSI C12.1.

2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording 30 minute integrated demand of totalized system.

2.4 CONTROL POWER

A. Control Circuits: supplied from switchboard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

F. Install filler plates in unused spaces of panel-mounted sections.

G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges based on coordination study.

H. Install spare-fuse cabinet.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

        1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Switchboard will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and service switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413

This Page Intentionally Left Blank

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards.Submit final versions after load balancing.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.11 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.12 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
4. Finishes:

a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top or Bottom as required.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
5. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: As shown on drawings.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
e. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges per coordination study.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate City of New York's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated on drawings.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Toggle Switches
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.
7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Building Owner/City of New York-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples:
1. One for each type of device and wall plate specified, in each color specified.
2. Receptacle tester for each type of device NEMA configuration specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Decorator-Style Devices: Unless noted otherwise or unavailable for an option, provide wiring devices with rectilinear, decorator-style faces.

D. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; 5351 (single), CR5362 (duplex).
   b. Hubbell; HBL5351 (single), HBL5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).
   d. Pass & Seymour; 5361 (single), 5362 (duplex).

2. Tamper-Resistant: Integral dual mechanical shutter system to help prevent insertion of foreign objects.

B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Cooper; IG5362RN.
   b. Hubbell; IG5362.
   c. Leviton; 5362-IG.
   d. Pass & Seymour; IG5362.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
3. Tamper-Resistant: Integral dual mechanical shutter system to help prevent insertion of foreign objects.

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

4. Tamper-Resistant: Integral dual mechanical shutter system to help prevent insertion of foreign objects.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

1) Single Pole:
a) Cooper; AH1221.
b) Hubbell; HBL1221.
c) Leviton; 1221-2.
d) Pass & Seymour; CSB20AC1.

2) Two Pole:
a) Cooper; AH1222.
b) Hubbell; HBL1222.
c) Leviton; 1222-2.
d) Pass & Seymour; CSB20AC2.

3) Three Way:
a) Cooper; AH1223.
b) Hubbell; HBL1223.
c) Leviton; 1223-2.
d) Pass & Seymour; CSB20AC3.

4) Four Way

a) Cooper; AH1224.
b) Hubbell; HBL1224.
c) Leviton; 1224-2.
d) Pass & Seymour; CSB20AC4.

C. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221PL for 120 and 277 V.
b. Hubbell; HBL1201PL for 120 and 277 V.
c. Leviton; 1221-LH1.
d. Pass & Seymour; PS20AC1RPL for 120 V, PS20AC1RPL7 for 277 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; AH1221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.7 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
3. Material for Unfinished Spaces: Galvanized steel Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.8 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

2.9 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.
4. Isolated-Ground Receptacles: Orange.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

This Page Intentionally Left Blank

SECTION 262813

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
   1. 601 Ampere or larger: Class L, fast acting.
   2. 600 Ampere or smaller: Class J, time delay.
   3. Fuses protecting Control Circuits: Class CC, time delay.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuseholders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

This Page Intentionally Left Blank

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

1.9 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.11 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Lugs: Compression type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Compression type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits..
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: Din-rail-mounted communication module with functions and features compatible with power monitoring and control system, specified in Section 260913 "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen Areas: NEMA 250, Type 4X,.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816

SECTION 262913

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:

1. Fractional horsepower manual controllers.
2. Combination controllers with starters and overcurrent protection.

B. Related Section:

1. Section 262923 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

E. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.9 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller.

1.11 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

1.12 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing.
3. Surface mounting.
4. Red pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button ; melting alloy type.
4. Surface mounting.
5. Red pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Square D; a brand of Schneider Electric.

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button ; melting alloy type.
4. Surface mounting.
5. Red pilot light.

E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Rockwell Automation, Inc.; Allen-Bradley brand.
d. Square D; a brand of Schneider Electric.

2. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J Class R fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

3. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
4. Nonfusible Disconnecting Means:

    a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

5. MCP Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
    b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
    d. N.C. or N.O. alarm contact that operates only when MCP has tripped.
    e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

6. MCCB Disconnecting Means:

    a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
    b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
    c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
    e. N.C. alarm contact that operates only when MCCB has tripped.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.
2. Outdoor Locations: Type 3R.
3. Other Wet or Damp Indoor Locations: Type 4.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, type.

a. Push Buttons: Recessed types; momentary as indicated.
b. Pilot Lights: LED types; colors as indicated; push to test.
c. Selector Switches: Rotary type.

B. Reversible N.C./N.O. auxiliary contact(s).

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

D. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Seismic Bracing: Comply with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch enclosed controller.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.

4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.

C. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Instruct City of New York's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 262923

VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.3 DEFINITIONS

A. BAS: Building automation system.

B. CE: Conformite Europeene (European Compliance).

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCP: Motor-circuit protector.

I. NC: Normally closed.

J. NO: Normally open.

K. OCPD: Overcurrent protective device.

L. PCC: Point of common coupling.

M. PID: Control action, proportional plus integral plus derivative.

N. PWM: Pulse-width modulated.

O. RFI: Radio-frequency interference.

DDC Project ID# CRO-AGS
Croton Above Ground
Structure and Landscaping

P. TDD: Total demand (harmonic current) distortion.

Q. THD(V): Total harmonic voltage demand.

R. VFC: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

B. LEED Submittals:

1. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.

C. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of enclosed unit.
f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
g. Specified modifications.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around VFCs. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

B. Qualification Data: For qualified testing agency.

C. Seismic Qualification Certificates: For VFCs, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.

D. Product Certificates: For each VFC, from manufacturer.

E. Harmonic Analysis Study and Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.

F. Source quality-control reports.

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals. In addition to items specified elsewhere, include the following:

1. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.
2. Manufacturer's written instructions for setting field-adjustable overload relays.
3. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
4. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
2. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. IEEE Compliance: Fabricate and test VFC according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller.

1.10 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.
2. Ratings and characteristics of supply circuit and required control sequence.
3. Ambient and environmental conditions of installation location.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Rockwell Automation, Inc.; Allen-Bradley Brand.
5. Siemens Energy & Automation, Inc.
6. Square D; a brand of Schneider Electric.
7. Toshiba International Corporation.

B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

C. Application: Constant torque and variable torque.

D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: Three-phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
2. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
3. Minimum Efficiency: 96 percent at 60 Hz, full load.
4. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or speed condition.
5. Minimum Short-Circuit Current (Withstand) Rating: As required.
6. Ambient Temperature Rating: Not less than 14 deg F and not exceeding 104 deg F.
7. Ambient Storage Temperature Rating: Not less than minus 4 deg F and not exceeding 140 deg F
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet.
10. Vibration Withstand: Comply with IEC 60068-2-6.
11. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
13. Speed Regulation: Plus or minus 5 percent.
14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, 32 bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.
2. Signal: Pneumatic.

J. Internal Adjustability Capabilities:

1. Minimum Speed.
2. Maximum Speed.
3. Acceleration.
4. Deceleration.
5. Current Limit.

K. Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable deadbands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.

O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

Q. Integral Input Disconnecting Means and OCPD: with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
3. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.
4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.

2.2 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

    a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).

6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

   a. A minimum of two programmable analog inputs: 0- to 10-V dc 4- to 20-mA dc.
   b. A minimum of six multifunction programmable digital inputs.

2. Pneumatic Input Signal Interface: 3 to 15 psig.
3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

   a. 0- to 10-V dc.
   b. 4- to 20-mA dc.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.

4. Output Signal Interface: A minimum of one programmable analog output signal(s) (0- to 10-V dc 4- to 20-mA dc), which can be configured for any of the following:

   a. Output frequency (Hz).
   b. Output current (load).
   c. DC-link voltage (V dc).
   d. Motor torque (percent).
   e. Motor speed (rpm).
   f. Set point frequency (Hz).

5. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

   a. Motor running.
   b. Set point speed reached.
   c. Fault and warning indication (overtemperature or overcurrent).
   d. PID high- or low-speed limits reached.

F. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.
2. Embedded BAS Protocols for Network Communications: ASHRAE 135 BACnet Echelon LonWorks Johnson Metasys N2 Modbus/Memobus Siemens System 600 APOGEE; protocols accessible via the communications ports.

2.3 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD and THD(V) at the defined PCC per IEEE 519.

B. Output Filtering: Load filters for motors that do not meet the requirements in NEMA MG1.

C. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2.

2.4 BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic control system feedback.

C. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.
2. Output Isolating Contactor: Non-load-break, NEMA-rated contactor.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

D. Bypass Contactor Configuration: Full-voltage (across-the-line) type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
    b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

2.5 OPTIONAL FEATURES

A. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

B. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

C. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from the firefighter's control station, this password-protected input:

1. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
2. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
3. Forces VFC to transfer to Bypass Mode and operate motor at full speed.
4. Causes display of Override Mode on the VFC display.
5. Reset VFC to normal operation on removal of override signal automatically.

D. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

E. Remote digital operator kit.

F. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer and a notebook computer.

2.6 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.7 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, type.

a. Push Buttons: Shielded types;.
b. Pilot Lights: LED types;.
c. Selector Switches: Rotary type.

B. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

C. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

2.8 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.
2. Verification of Performance: Rate VFCs according to operation of functions and features specified.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HARMONIC ANALYSIS STUDY

A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze designated operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

B. Prepare a harmonic analysis study and report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.3 INSTALLATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

C. Seismic Bracing: Comply with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in each fusible-switch VFC.

F. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

G. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

H. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

I. Comply with NECA 1.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each VFC with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic control devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation.Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect Construction Manager before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. VFCs will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.7 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager before increasing settings.

D. Set the taps on reduced-voltage autotransformer controllers.

E. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

F. Set field-adjustable pressure switches.

3.9 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct the City of New York's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923

This Page Intentionally Left Blank

SECTION 263323

CENTRAL BATTERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. This Section includes fast-transfer central battery inverters.

1.3 DEFINITIONS

A. LCD: Liquid-crystal display.

B. LED: Light-emitting diode.

C. THD: Total harmonic distortion.

D. UPS: Uninterruptible power supply.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Electrical ratings, including the following:

    a. Capacity to provide power during failure of normal ac.
    b. Inverter voltage regulation and THD of output current.
    c. Rectifier data.
    d. Transfer time of transfer switch.
    e. Data for specified optional features.

2. Transfer switch.
3. Inverter.
4. Battery charger.
5. Batteries.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.

1. Wiring Diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring.
2. Elevation and details of control and indication displays.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that central battery inverter equipment will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For central battery inverter equipment to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Central Battery Inverter System: UL 924 listed.

C. Comply with NFPA 70 and NFPA 101.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in fully enclosed vehicles.

B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.

1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:

a. Lead-Calcium, Wet-Cell Batteries:

1) Full Warranty: One year.

2) Pro Rata: Nine years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Chloride Systems.
2. Cooper Industries, Inc.; Sure-Lites Division.
3. Dual-Lite.
4. Lithonia Lighting; Emergency Lighting Systems.

2.2 INVERTER PERFORMANCE REQUIREMENTS

A. Fast-Transfer Central Battery Inverters: Automatically sense loss of normal ac supply and use a solid-state switch to transfer loads. Transfer in 0.002 second or less from normal supply to battery-inverter supply.

1. Operation: Unit supplies power to output circuits from a single, external, normal supply source. Unit automatically transfers load from normal source to internal battery/inverter source. Retransfer to normal is automatic when normal power is restored.

2.3 SERVICE CONDITIONS

A. Environmental Conditions: Inverter system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Ambient Temperature for Electronic Components: 68 to 85 deg F.
2. Relative Humidity: 0 to 95 percent, noncondensing.
3. Altitude: Sea level to 100 feet .

2.4 INVERTERS

A. Description: Solid-state type, with the following operational features:

1. Automatically regulate output voltage to within plus or minus 5 percent.
2. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load at unit power factor over the operating range of battery voltage.
3. Output Voltage Waveform of Unit: Sine wave with maximum 10 percent THD throughout battery operating-voltage range, from no load to full load.

    a. THD may not exceed 5 percent when serving a resistive load of 100 percent of unit rating.

4. Output Protection: Current-limiting and short-circuit protection.
5. Overload Capability: 125 percent for 10 minutes; 150 percent surge.

2.5 BATTERY CHARGER

A. Description: Solid-state, automatically maintaining batteries in fully charged condition when normal power is available. With LED indicators for "float" and "high-charge" modes.

2.6 BATTERIES

A. Description: Maintenance-free, sealed, lead-calcium, wet-cell batteries, capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.

2.7 ENCLOSURES

A. NEMA 250, Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.

B. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

2.8 SEISMIC REQUIREMENTS

A. Central battery inverter assemblies, subassemblies, components, fastenings, supports, and mounting and anchorage devices shall be designed and fabricated to withstand seismic forces. The term "withstand" is defined in the "Manufacturer Seismic Qualification Certification" Paragraph in Part 1 "Informational Submittals" Article.

2.9 CONTROL AND INDICATION

A. Description: Group displays, indications, and basic system controls on common control panel on front of central battery inverter enclosure.

B. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.

C. Indications: Labeled LED and plain-language messages on a digital LCD or LED.

1. Quantitative Indications:

   a. Input voltage, each phase, line to line.
   b. Input current, each phase, line to line.
   c. System output voltage, each phase, line to line.
   d. System output current, each phase.
   e. System output frequency.
   f. DC bus voltage.
   g. Battery current and direction (charge/discharge).
   h. Elapsed time-discharging battery.

2. Basic Status Condition Indications:

   a. Normal operation.
   b. Load-on bypass.
   c. Load-on battery.
   d. Inverter off.
   e. Alarm condition exists.

3. Alarm Indications:

   a. Battery system alarm.
   b. Control power failure.
   c. Fan failure.
   d. Overload.
   e. Battery-charging control faulty.
   f. Input overvoltage or undervoltage.
   g. Approaching end of battery operation.
   h. Battery undervoltage shutdown.
   i. Inverter fuse blown.
   j. Inverter transformer overtemperature.
   k. Inverter overtemperature.
   l. Static bypass transfer switch overtemperature.
   m. Inverter power supply fault.
   n. Inverter output overvoltage or undervoltage.
   o. System overload shutdown.
   p. Inverter output contactor open.
   q. Inverter current limit.

4. Controls:

   a. Inverter on-off.
   b. Start.
   c. Battery test.
   d. Alarm silence/reset.

e. Output-voltage adjustment.

D. Enclosure: Steel, with hinged lockable doors, suitable for wall mounting. Manufacturer's standard corrosion-resistant finish.

2.10 OPTIONAL FEATURES

A. Emergency-Only Circuits: Automatically energize only when normal supply has failed. Disconnect emergency-only circuits when normal power is restored.

B. Maintenance Bypass/Isolation Switch: Switch is interlocked so it cannot be operated unless static bypass transfer switch is in bypass mode. Switch provides manual selection among the following three conditions without interrupting supply to the load during switching:

1. Full Isolation: Load is supplied, bypassing central battery inverter system. Normal ac input circuit, static bypass transfer switch, and central battery inverter load terminals are completely disconnected from external circuits.
2. Maintenance Bypass: Load is supplied, bypassing central battery inverter system. Central battery inverter ac supply terminals are energized to permit operational checking, but system load terminals are isolated from the load.
3. Normal: Normal central battery inverter ac supply terminals are energized and the load is supplied either through static bypass transfer switch and central battery inverter rectifier-charger and inverter or through battery and inverter.

2.11 SOURCE QUALITY CONTROL

A. Factory test complete inverter system, including battery, before shipment. Include the following:

1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
2. Full-load test.
3. Transient-load response test.
4. Overload test.
5. Power failure test.

B. Observation of Test: Give 14 days' advance notice of tests and provide access for City of New York's representative to observe tests at City of New York's option.

C. Report test results. Include the following data:

1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
3. List of instruments and equipment used in factory tests.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install system components on wall per manufacturer's written instructions.

1. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems" for seismic-restraint requirements.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 CONNECTIONS

A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify equipment and components according to Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
2. Test manual and automatic operational features and system protective and alarm functions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Verify that central battery inverter is installed and connected according to the Contract Documents.

C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.

D. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING AND CLEANING

A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

B. Install new filters in each equipment cabinet within 14 days from date of Substantial Completion.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain central battery inverters. Refer to DDC General Conditions.

END OF SECTION 263323

SECTION 265100

LIGHTING FIXTURES AND DEVICES

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.02 SECTION INCLUDES

A. All work shall be in accordance with the requirements of the General Specification 265100 – Lighting Fixtures and Devices except as modified herein. The following paragraphs modify and supplement the correspondingly numbered paragraphs of General Specification 265100 - Lighting Fixtures and Devices.

1.03 RELATED SPECIFICATIONS

A. DDC General Conditions - LEED Performance Requirements

B. DDC General Conditions - Low Emitting Indoor Materials

C. DDC General Conditions - Construction Waste Management

D. DDC General Conditions - Start Up and Commissioning Testing

1.04 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Emergency lighting units including battery and charger.

3. Ballast.

4. Energy-efficiency data.

5. Life, output, and energy-efficiency data for lamps.

6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

   a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

   1. Wiring Diagrams: Power and control wiring.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Lighting fixtures.

   2. Suspended ceiling components.

   3. Structural members to which suspension systems for lighting fixtures will be attached.

   4. Other items in finished ceiling including the following:

      a. Air outlets and inlets.
      b. Speakers.
      c. Sprinklers.
      d. smoke and fire detectors.
      e. Occupancy sensors.
      f. Access panels.
      g. Perimeter moldings.

D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

   1. Lamps: Specified units installed.

   2. Accessories: Cords and plugs.

E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

F. Qualification Data: For agencies providing photometric data for lighting fixtures.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

I. Warranties: Special warranties specified in this Section.

J. LEED Submittal Requirements:

1. For all field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 01301 LEED Certification Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

2. Provide back-up documentation to validate information provided on the VOC REPORTING forms. For each material listed on the Forms, provide documentation to certify each of the material VOC content.

3. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

4. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies

1.05 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 SPARE PARTS

G. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed for HID and fluorescent lamps. 200 for every 100 of each type and rating for incandescent lamps. Furnish at least two of each type.
   2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Battery and Charger Data: One> for each emergency lighting unit.
   4. Ballasts: 5 for every 100 of each type and rating installed. Furnish at least two of each type.
   5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

1.07 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
   2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

1.08 SUMMARY

A. This Section includes the following:

   1. Interior lighting fixtures, lamps, and ballasts.

   2. Emergency lighting units.

   3. Exit Signs.

B. Related Sections include the following:

1. 260923 - Lighting Control Devices for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. 260943.23 - Relay Based Lighting Controls for manual or programmable control systems with low-voltage control wiring or data communication circuits.
3. 262726 - Wiring Devices for manual wall-box dimmers for incandescent lamps.

1.09 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.10 LEED PERFORMANCE REQUIREMENTS

H. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements DDC General Conditions.

PART 2 PRODUCTS

2.01 LIGHT FIXTURES

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

K. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Section "Diffusers, Registers, and Grilles."

1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
2. Heat Removal Units: Air path leads through lamp cavity.
3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.
4. Dampers: Operable from outside fixture for control of return-air volume.
5. Static Fixture: Air supply slots are blanked off, and fixture appearance matches active units.

2.02 LAMPS

A. Lamps shall be by General Electric Company, Sylvania Company, Philips or approved equal.

B. Low-Mercury Fluorescent Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

C. T8 rapid-start low-mercury fluorescent lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.

D. T8 rapid-start low-mercury fluorescent lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.

E. T5 rapid-start low-mercury lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K and average rated life of 20,000 hours, unless otherwise indicated.

F. T5HO rapid-start, high-output low-mercury fluorescent lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.

G. Compact Fluorescent Lamps: 4-Pin,low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

H. Metal-Halide HID Lamps: ANSI C78.1372, with a minimum CRI 70, and color temperature 4000 K.

I. Pulse-Start, Metal-Halide HID Lamps: Minimum CRI 70, and color temperature 4000 K.

J. Ceramic, Pulse-Start, Metal-Halide HID Lamps: Minimum CRI 80 , and color temperature 4000 K.

2.03 BALLASTS

A. Fluorescent Ballasts:

1. Electronic Ballasts: Comply with ANSI C82.11; programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

2. Sound Rating: A, except B for T12/HO and T12/Slimline lamp ballasts.

a. Total Harmonic Distortion Rating: Less than 10 percent.
b. Transient Voltage Protection: IEEE C62.41, Category A or better.
d. -Operating Frequency: 20 kHz or higher.
e. Lamp Current Crest Factor: 1.7or less.
f. BF: 0.85 or higher.
g. Power Factor: 0.95 or higher.
h. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

3. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:

   a. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
   b. Automatic lamp starting after lamp replacement.
   c. Sound Rating: A.
   d. Total Harmonic Distortion Rating: Less than 20 percent.
   e. Transient Voltage Protection: IEEE C62.41, Category A or better.
   f. Operating Frequency: 20 kHz or higher.
   g. Lamp Current Crest Factor: 1.7 or less.
   h. BF: 0.95 or higher, unless otherwise indicated.
   i. Power Factor: 0.95 or higher.

4. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

   a. Ballast Manufacturer Certification: Indicated by label.

5. Ballasts for Low-Temperature Environments:

   a. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
   b. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

6. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

7. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

   a. Dimming Range: 100 to 10 percent of rated lamp lumens.

   b. Ballast Input Watts: Can be reduced to 20 percent of normal.

8. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

   a. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
   b. High-Level Operation: 100 percent of rated lamp lumens.
   c. Low-Level Operation: 30 percent of rated lamp lumens.
   d. Ballast shall provide equal current to each lamp in each operating mode.
   e. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

B. High Intensity Discharge Ballasts:

1. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:

a. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
b. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
c. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
d. Open-circuit operation that will not reduce average life.
e. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

2. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

a. Lamp end-of-life detection and shutdown circuit.
b. Sound Rating: A.
c. Total Harmonic Distortion Rating: Less than 15 percent.
d. Transient Voltage Protection: IEEE C62.41, Category A or better.
e. Lamp Current Crest Factor: 1.5 or less.
f. Power Factor: .90 or higher.
g. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
h. Protection: Class P thermal cutout.
i. Retain subparagraph and associated subparagraphs below for bi-level ballasts.
j. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.

1. High-Level Operation: 100 percent of rated lamp lumens.
2. Low-Level Operation: 35 percent of rated lamp lumens.
3. Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.

3. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

4. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

a. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.

1. Restrike Range: 105- to 130-V ac.
2. Maximum Voltage: 250-V peak or 150-V ac RMS.

b. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
c. Open-circuit operation shall not reduce average lamp life.

5. Ballasts for Compact Fluorescent Lamps

6. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

   a. Lamp end-of-life detection and shutdown circuit.
   b. Automatic lamp starting after lamp replacement.
   c. Sound Rating: A.
   d. Total Harmonic Distortion Rating: Less than 20 percent.
   e. Transient Voltage Protection: IEEE C62.41, Category A or better.
   f. Operating Frequency: 20 kHz or higher.
   g. Lamp Current Crest Factor: 1.7 or less.
   h. BF: 0.95 or higher, unless otherwise indicated.
   i. Power Factor: 0.95 or higher.
   j. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
   k. Ballast Case Temperature: 75 deg C, maximum.

7. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

   a. Dimming Range: 100 to 10 percent of rated lamp lumens.
   b. Ballast Input Watts: Can be reduced to 20 percent of normal.
   c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.04 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Night-Light Connection: Operate one fluorescent lamp continuously.
3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Battery: Sealed, maintenance-free, nickel-cadmium type.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Housing: NEMA 250, Type 1 enclosure.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.05 LED LUMINAIRES & LIGHT SOURCES

A. FINAL SELECTION OF LED LIGHT SOURCES

1. To account for the continual development of LED light source efficacy all luminaires equipped with LED are specified noting the lumen output required. The final selection of LED light source used within the specified fixture shall be made during the submittal phase of the project to ensure the project benefits from increases in efficiency that will occur between specification and submittal. For all LED products specified the Contractor shall submit the fixture specified with the current LED technology available within the specified fixture range at the time of submittal, ensuring that the required lumen output is achieved. If the specified fixture has been updated the revised fixture shall achieve a minimum light output ratio equal to the luminaire specified.

B. COLOR TOLERANCE

1. Unless otherwise specified, all LED light sources shall achieve a minimum color tolerance of at least 3-step ellipse, measured for both initial and at 25% of rated life. Colour tolerance beyond this is unacceptable.

C. COLOR RENDERING

1. Color rendering index (CRI) of all LED light sources shall achieve the minimum CRI specified initially and at 25% of rated life. No variation in CRI between initial and 25% rated life is acceptable.

D. LIFE

1. Lifetime testing of LED light sources shall be carried out in accordance with LM-80-08. All LED light sources shall achieve a minimum performance of L70, where rated life of the LED light source is defined as the time taken to reach 70% of the initial lumen output.

E. All LED light sources shall achieve a minimum lifetime of 50,000 hours at L70.

F. All LED light sources shall not exceed a failure fraction of 10% (F10) at rated life (L70).

G. LUMEN DEPRECIATION

Unless otherwise specified, all LED light sources shall provide a maximum lumen depreciation of 30% over the rated life of the product.

H. POWER FACTOR

LED drivers shall achieve a minimum power factor of 0.9.

I. LUMINAIRE TESTING

1. General. The following tests shall be undertaken for all LED products specified, including those identified as custom products. Confirmation that these tests have been carried out and passed is required during submittal.
2. Temperature cycling shock test. The non-energised LED luminaire shall be stored firstly at (minus) -20°C for 1 hour. The luminaire shall then be immediately moved into a cabinet having a temperature of (plus) +35 °C and stored for 1 hour. Five such cycles shall be carried out. At the end of the test the LED luminaire shall operate and remain alight for 15 min.
3. Supply voltage switching test. At test voltage the luminaire shall be switched on and off for 30 seconds. The cycling shall be repeated for a number equal to half the rated luminaire life in hours (example: 10K cycles if rated luminaire life is 20 000 hours). At the end of the test the LED luminaire shall operate and remain alight for 15 min.
4. Thermal endurance test. The LED luminaire shall be operated at nominal voltage and at an ambient temperature of (plus) +35°C for outdoor luminaires, (plus) +25°C for indoor luminaires and (plus) +35°C for recessed luminaires until a test period equal to 25 % of the rated luminaire life (with a maximum of 6 000 hours) has passed. At the end of this time, and after cooling down to room temperature, the luminaire shall remain alight for at least 15 min.

J. LED LIGHT SOURCE AND LUMINAIRE DATA

1. The following data for LED light sources shall be submitted for approval with all luminaires equipped with LED light sources:

K. Initial Luminaire Lumen Output at 1,000 hours (L1000).

L. Ra14 color rendering data, in addition to the general color rendering index Ra. Provide initial and data at 25% of rated life.

M. Color tolerance data, initial and at 25% of rated life, including the chromaticity coordinates of the bin.

N. Rated power of the luminaire including driver.

O. Power factor of the luminaire including driver, initial and at 25% of rated life.

P. Absolute photometry report in accordance with LM-79-08.

Q. LED light source test reports in accordance with LM-80-08.

2.06 RECEPTACLES AND SWITCHES

A. Switches:
   1. Switches shall be by Hubbel Incorporated, Arrow-Hart Incorporated or approved equal. Hazardous located receptacles shall be by Crouse-Hinds Company, Appleton Electric Company, Lutron, Crestron or approved equal.

B. Plates and Covers:
   1. Plates shall be by Hubbel Incorporated, Arrow-Hart Incorporated or approved equal. Covers shall be by Crouse-Hinds Company, Appleton Electric Company, Lutron, Crestron or approved equal

2.07 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   3. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.08 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
   2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

      a. Battery: Sealed, maintenance-free, nickel-cadmium type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.
c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

C. Master/Remote Sign Configurations:

1. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
2. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.09 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.10 REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

A. Fixture Type: See Architectural Drawings.

PART 3 EXECUTION

3.01 INSTALLATION OF LUMINAIRES

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Section "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 283111

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Firefighters' two-way telephone communication service.
8. Magnetic door holders.
9. Remote annunciator.
10. Addressable interface device.
11. Data Gathering Panel
12. Digital alarm communicator transmitter.
13. Radio alarm transmitter.
14. System printer.

1.3 DEFINITIONS

A. AHJ: Authorities having jurisdiction

B. EMT: Electrical Metallic Tubing

C. FACP: Fire Alarm Control Panel

D. DGP: Data Gathering Panel

E. HLI: High Level Interface

F. LED: Light-emitting diode.

G. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Commissioner.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level IV minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Engineering Services Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Provide additional detector as required per design intent for coverage.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:

    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.

5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm technician.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.

H. NFPA Certification: Obtain certification according to NFPA 72 by.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Commissioner Construction Manager City of New York no fewer than two days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Construction Manager's City of New York's written permission.

1.11 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.12 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for one year.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to City of New York to allow scheduling and access to system and to allow City of New York to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Faraday; Siemens Building Technologies, Inc.
2. Fire Control Instruments, Inc.; a Honeywell company.
3. Fire Lite Alarms; a Honeywell company.
4. GAMEWELL; a Honeywell company.
5. GE Infrastructure; a unit of General Electric Company.
6. Gentex Corporation.
7. Harrington Signal, Inc.
8. NOTIFIER; a Honeywell company.
9. Siemens Building Technologies, Inc.; Fire Safety Division.
10. Silent Knight; a Honeywell company.

11. SimplexGrinnell LP; a Tyco International company.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Verified automatic alarm operation of smoke detectors.
6. Automatic sprinkler system water flow.
7. Heat detectors in elevator shaft and pit.
8. Fire-extinguishing system operation.
9. Fire standpipe system.
10. Fire Pump running.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
9. Activate stairwell and elevator-shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Recall elevators to primary or alternate recall floors.
12. Activate emergency lighting control.
13. Activate emergency shutoffs for gas and fuel supplies.
14. Record events in the system memory.
15. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.

5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

   a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.

2. Addressable initiation devices that communicate device identity and status.

   a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
   b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

3. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

   a. Initiating Device Circuits: Style B.
   b. Notification Appliance Circuits: Style Z.

c. Signaling Line Circuits: Style 4.
d. Install no more than 50 addressable devices on each signaling line circuit.

2. Serial Interfaces: Two RS-232 ports for printers.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Notification Appliance Circuit: Operation shall sound in a temporal 3 pattern.

F. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.

a. Elevator lobby detectors except the lobby detector on the designated floor.
b. Smoke detector in elevator machine room.
c. Smoke detectors in elevator hoistway.

2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

J. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

K. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.

L. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 DATA GATHERING PANELS

A. DGP: Transponder with field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL. Networked communication with FACP with ability to function as stand-alone panel upon loss of communication. Transmits and receives alarm, supervisory, and trouble signals to and from the FACP.

B. Initiating Device Circuit: Functions for monitoring of addressable initiation devices equal to that of FACP.

C. Notification Appliance Circuit: Functions for notification appliances, control relays, etc. equal to that of FACP.

D. Printer: Includes printer port and capable to generate printout for all incident on entire fire alarm system, equal to that of FACP.

E. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

F. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.5 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Station Reset: Key- or wrench-operated switch.
4. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.6 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

    a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.

D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.

E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.

F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

G. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: Flush.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.8 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing signals for fire safety functions..

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Zone of the supervisory signal.
3. Zone of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by manufacturer of device.
2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches above the finished floor.

1. Install seismic bracing. Comply with requirements in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

D. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

E. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
5. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

G. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

H. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

I. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

J. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.

L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

M. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

N. Annunciator: Install with top of panel not more than 72 inches above the finished floor.

3.2 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Alarm-initiating connection to elevator recall system and components.
5. Alarm-initiating connection to activate emergency lighting control.
6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches.
8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents,

Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to instruct City of New York's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

This Page Intentionally Left Blank

SECTION 311000

SITE CLEARING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. The Removal of Designated Trees.

2. The Protection and Trimming of Existing Trees to Remain.

3. The Pruning and Removal of Dead Wood from Existing Trees to Remain.

1.3 RELATED SECTIONS

A.	Sustainability Requirements	– Section 013010
B.	Exterior Plantings	– Section 329300
C.	Plantings for Wetland Areas	– Section 327200
D.	Soil Mixes for Wetland Areas	– Section 327500
E.	Planting Soil Mixes	- Section 329113

1.4 REFERENCES

A. ISA-International Society of Arboriculture

B. ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance—Standard Practices (Pruning)."

1.5 DEFINITIONS

A. Clearing: Clearing is the removal from the ground surface and disposal, within the designated areas, of trees, brush, shrubs, down timber, decayed wood, other vegetation, rubbish, trash, scrap, metal, debris and miscellaneous other structures not covered under othser Sections as shown on the Contract Drawings, specified or otherwise required to permist construction of the new Work.

B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots larger than 2 inches, matted roots and organic materials.

C. Tree Protection Zone: Area surrounding individual trees or groups of trees to remain during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and Standards: State and local laws and code requirements shall govern the hauling and disposal of trees, shrubs, stumps, roots, rubbish, debris and other matter.

C. Tree Service Firm Qualifications: An experience tree service firm that has successfully completed tree removal work, tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to the Project site during execution of the designated tree removal, tree protection and trimming work.

D. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.

E. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance—Standard Practices (Pruning)."

1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, the Commissioner, the Construction Manager, and other concerned entities to review tree protection and trimming procedures and responsibilities.

1.7 SUBMITTALS

A. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

B. Qualication Data: For tree service firm and arborist.

C. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

D. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing Work.

E. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as a basis for rejecting the submitted products or assemblies.

1.8 PROJECT/SITE CONDITIONS

A. Street, roads, adjacent property and other works and structures shall be protected throught the entire project. Contractor shall return to original condition, satisfactory to the Commissioner, facilities damaged by the Contractor's operations.

1.9 GUARANTEE

A. The Contractor shall guarantee that work performed under this Section will not permanently damage trees, shrubs, turf or plants designated to remain, or other adjacent work or facilities. If damage resulting from Contractor's operations appears during the period up to 12 months after completion of the project, the Contractor shall replace damaged items at no expense to the City.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TREES AND SHRUBS TO BE SAVED

A. Protection: The Contractor shall protect from defacement, injury and destruction all trees and shrubs within the construction site that are so delineated or are marked in the field to be saved. Trees, shrubs and grassed areas which are to remain shall be protected by fences, barricades, wrapping or other methods as shown on the Contract Drawings, specified or approved by the City of New York and the Commissioner.

1. Within the limits of the tree drip line, work shall be performed with extreme care using either hand tools or equipment that will not cuase damage to the trees.

   a. Do not disturb or cut roots unnecessarily. Do not cut roots 2 inches and larger unless approved by the Arborist and/or the Commissioner.

   b. Immediately backfill around tree roots after completionof construction in the vicinity of trees.

   c. Do not operate any wheeled or tracked equipment within drip line.

2. Vegetation shall be protected from damage caused by emissions from engine-powered equipment.

3. During working operations, the trunk, foliage and root system of all trees to be saved shall be protected with boards or other guards placed as shown on the Contract Drawings and as required to prevent damage, injury and defacement.

   a. Excavated materials shall not be piled within the drip line or adjacent to the trunks of the trees. Equipment, stockpiles, and etc., shall not be permitted within the drip line.

   b. Do not allow runoff to accumulate around trunks of trees.

   c. Ropes, cable, or guy wires shall not be fastened or attached to trees without permission. When such permission is granted, protect the tree before making fastening or attachments by providing burlap wrapping and softwood cleats.

   d. The use of axes of climbing spurs for trimming will not be permitted.

   e. Provide climbing ropes during trimming.

4. Shrubs to be saved shall be removed by taking a sufficient earth ball with roots to maintain the shrub.

a. Temporarily replant, if required, and replace at the completion of construction in a condition equaling that which existing prior to removal.

b. Replace in kind if the transplant fails. Provide transplanting, planting, and watering and guarantee as specified in Specification Section 329200 Exterior Plantings.

5. Any tree and shrub repair shall be performed by a tree surgeon and/or arborist properly licensed by the State of New York and within 24 hours after damage occurred. Treat damaged trunks, limbs, and roots according to the tree surgeon and/or arborist's written instructions.

6. Trees and shrubs intended to remain which are removed, die or damaged beyond repair and are determined by the Commissioner as incapable of restoring to normal growth pattern, shall be replaced by the Contractor.

3.2 TREES AND SHRUBS TO BE REMOVED

A. Tree Removal within Property Limits:

1. Trees and shrubs shall only be removed at the direction of the City of New York. Roots, stumps, and other items to be removed shall become the property of the Contractor and removed from the Site.

2. All designated trees, including the root to a depth of three (3) feet below the surface, and shrubs within the construction limit lines shall be removed unless otherwise indicated.

3. The Contractor shall carefully protect against damage all existing trees, shrubs, plants and other features to remain. He shall be liable for any damage to such trees, shrubs, plants, park features and other property caused by tree removal operations and all damaged property shall be replaced or restored to its original condition to the satisfaction of the Commissioner.

4. Do not cut or damage trees or shrubs outside of the Contract limit lines. Damage outside the Contract limit lines caused by the Contractor's operations shall be corrected at the Contractor's expense.

B. The stumps and roots of these trees shall be removed to a depth of three (3) feet below the ground surface except in areas of fill greater than three (3) feet, where such trees may be cut flush with the ground surface. All voids and excavations left after removal of the tree and roots shall be backfilled to grade with clean earth fill. The fill shall be placed and compacted by acceptable methods to the satisfaction of the Commissioner. Chips generated by root removal operations shall be removed prior to backfilling.

C. Cutting of trees shall be done by competent workmen only and a in workmanlike manner. All trees shall be "topped" and "limbed" previous to felling unless otherwise directed by the Commissioner. All branches, limbs, trunks, stumps, roots and other

debris shall be removed from the site or otherwise disposed of to the satisfaction of the Commissioner.

D. No trees are to be removed except as designated by the Commissioner.

E. Tree Removal outside Property Limits: The Contractor shall not cut or damage trees outside the property limits unless shown on the Contract Drawings to be removed or unless written permission before removal operations commence. Damage outside the property limits caused by the Contractor's operations shall be corrected at the Contractor's expense.

F. If, when removing the stumps, existing walks or curbs are disturbed, the Contractor shall restore and/or reset these walks and curbs, at no additional cost, to the satisfaction of the Engineer. The Contractor is responsible for locating and protecting underground utilities from damage during excavation and/or grinding of stumps.

3.3 CLEARANCE AND GRUBBING

A. Clearing: The Contractor shall clear all items specified to the Contract limit lines shown on the Contract Drawings and shall remove cleared and grubbed materials from the site to an authorzie disposal site.

1. Do not start earthwork operations in areas where clearing and grubbing is not complete, except that stumps and large roots may be removed concurrent with excavation.

B. Grubbing: The Contractor shall clear and grub areas to be excavated, areas receiving less than 3 feet of fill and areas upon which structures are to be constructed.

1. Stumps and root mats in these areas shall be removed to depth of not less than 1 foot below the subgrade of sloped surfaces.

C. The stumps and roots shall be removed to a depth of three (3) feet below the ground surface except in areas of fill greater than three (3) feet, where such plant material may be cut flush with the ground surface. All voids and excavations left after removal of the plants and roots shall be backfilled to grade with clean earth fill. The fill shall be placed and compacted by acceptable methods to the satisfaction of the Commissioner. Chips generated by root removal operations shall be removed prior to backfilling.

D. Burning:

1. Burning of cleared and grubbed materiasl is not allowed within the property limits.

2. All burning off-site shall be in complete accordance with rules and regulations of local authorities having jurisdiction.

E. Explosives shall not be used.

F. No cleared or grubbed material may be used in backfills or structural embankments.

G. Cleared and grubbed items shall become property of the Contractor and shall be removed from the site and satisfactorily disposed of as specified in General Conditions Specification section 017419 Construction Waste Management and Disposal.

H. Cutting of trees shall be done by competent workmen only and a in workmanlike manner. All trees shall be "topped" and "limbed" previous to felling unless otherwise directed by the Commissioner. All branches, limbs, trunks, stumps, roots and other debris shall be removed from the site or otherwise disposed of to the satisfaction of the the Commissioner.

I. No trees are to be removed except as designated by the Commissioner.

J. Air pollution caused by dust and dirt shall be controlled, complying with governing regulations.

3.4 PREPARATION

A. Site Walk Through: The Contractor will inspect the Project Site with the the Commissioner. Trees designated for removal by the Commissioner will be tagged or clearly marked by the Contractor for removal.

B. Temporary Fencing: Install temporary barrier around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.

C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, excessive wetting caused by dewatering operations.

D. Maintain tree protection zones free of weeds and trash.

E. Do not allow fires within tree protection zone.

3.5 EXCAVATION

A. Do not excavate within tree protection zones, unless otherwise indicated.

B. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-time spading forks and comb soil to expose roots.

1. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practival, cut roots approximately 3 inches back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

C. Where utility trenches are required within the tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. But roots with sharp pruning instruments; do not break or chop.

3.6 REGRADING

A. Maintain existing grades within tree protection zones and with trees and shrubs to be saved.

B. Minor Fill: Where existing grade is 6 inches or less below the elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations and approved by the Commissioner.

3.7 TREE PRUNING

A. Prune trees to remain that are affected by temporary and permanent construction.

B. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by the Arborist.

C. Pruning Standards: Prune trees according to ANSI A300.

1. Type of Pruning: Remove dead wood, or broken or structurally unsound limbs from existing trees to remain.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Chip removed tree branches and stockpile in areas approved by the Commissioner dispose of off-site.

END OF SECTION

SECTION 312000

EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Geotechnical Design Report prepared for The Croton Water Treatment Plant at Mosholu Golf Course, Van Cortlandt Park, Borough of Bronx, City of New York, prepared by Metcalf & Eddy of New York, Inc & Hazen and Sawyer, P.C., dated November 2000, including the associated drawings, data report and appendices.

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform excavation, backfill, trenching, compaction, and paving, as necessary to construct the improvements as shown on the Contract Drawings or as directed by the Commissioner, which include but not limited to:

1. Prepare subgrades for wetland cells and stormwater management basins, underground detention.
2. Prepare subgrades for turf, grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Subbase course for concrete walks and pavement.
5. Subbase course and base course for asphalt paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.3 RELATED SECTIONS

A. Section 311000 - Site Clearing

B. Section 312316 - Rock Removal

C. Section 312319 - Dewatering

D. Section 312500 - Erosion and Sediment Controls

E. Section 315000 - Excavation Support and Protection

F. Section 329300 - Exterior Plantings

G. Section 329113 - Planting Soil Mixes

H. Section 033000 - Cast-in-Place Concrete

I. Section 334600 - Subdrainage

J. Section 334610 - Stormwater Underground Detention

1.4 DEFINITIONS

A. Backfill: Soil material or controlled suitable material used to fill an excavation.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Pipe Bedding: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Bedding: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

G. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Commissioner.

H. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimeion without direction by Commissioner. Un-authorized excavation, as well as remedial work directed by Commissioner, shall be without additional compensation.

I. Fill: Soil materials used to raise existing grades.

J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

L. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

M. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

N. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

O. Rough Grading: Initial grading for the preparation of the finished subgrade prior to placement of Planting Soils, Structural Soils, and Paving. Refer to the Contract Drawings for the depth of finished subgrade below the finished grade. The rough grade of the subgrade shall be smooth, uniform, and parallel to the finished grade.

P. Finished Grading: Fine grading of the soil to achieve the forms and contours as per the Contract Drawings.

Q. Contaminated Soil: As defined by the analysis entitled 'Limited Phase II Environmental Site Investigation (ESI)' dated June 6, 2016.

1.5 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

B. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Commissioner and authorities having jurisdiction.

C. Provide alternate routes around closed or obstructed traffic ways if required by Commissioner or authorities having jurisdiction.

D. Utility Locator Service: Notify "One Call" for area where Project is located before beginning earth moving operations.

E. Do not commence earth moving operations until temporary erosion and sediment control measures, specified in Section 312500 "Erosion and Sediment Control" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3. Foot traffic.

4. Erection of sheds or structures.

5. Impoundment of water.

6. Excavation or other digging unless otherwise indicated.

7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

1.6 QUALITY CONTROL

A. Contractor qualifications for the grading operations: Engage an experience Contractor who has completed rough and fine grading work similar in material, on-structure conditions, design and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Submit the name, contract information and qualifications of the grading contractor for approval by the Commissioner. Submittal shall include the names and contract information that best represent the firm's qualifications. All representative work shall have been completed within the previous three years.

2. Installer Field Supervision: Require installer to maintain full-time supervisor during times rough and fine grading work is in progress.

3. Submit the name and qualifications of the Installer Field Supervisor for approval by the Commissioner.

1.7 SUBMITTALS

A. LEED SUBMITTALS REQUIREMENTS

1. For all installed products and materials of this Section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

5. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

B. As defined by the Limited Phase II Environmental Site Investigation (ESI)' dated June 6, 2016, a Materials Handling Plan (MHP) and an HASP shall be submitted by the contractor prior to performing and excavation on site.

1.8 REFERENCES

A. ASTM C131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

B. ASTM C143 - Slump of Portland Cement Concrete

C. ASTM C330 - Lightweight Aggregates for Structural Concrete

D. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils

E. ASTM D698 - Test Method for Laboratory Compaction in Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)

F. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

G. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)

H. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

I. ASTM D2922 - Standard Test Methods for Density of Soil and SoilAggregatein Place by Nuclear Methods (Shallow Depth)

J. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

K. ASTM D4832 - Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Cylinders

L. ASTM D6023 - Test Method for Unit Weight, Yield, Cement Content, and Air Content (Gravimetric) of Controlled Low Strength Material (CLSM)

M. ASTM D6024 - Test Method for Ball Drop on Controlled Low Strength Material (CLSM) to Determine Suitability for Load Application

PART 2 PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification - Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145, or a combination of these groups; free of rock or gravel larger than 3 inches75 mm in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: 32
2. Plasticity Index: 17

C. Unsatisfactory Soils: Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural crushed gravel or crushed stone; ASTM D 2940; with at least 90 percent passing a 3/4-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel or crushed stone; ASTM D 2940; with at least 80 percent passing a 1-inch sieve and not more than 10 percent passing a No. 200 sieve.

F. Engineered Fill: Well-graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Pipe Bedding and Drainage Bedding: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

H. Filter Material: Sand and gravel with less than 15% silt.

I. Sand: ASTM C 33; fine aggregate.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Reference Specification Section 313219 - Geosynthetic Soil Stabilization and Layer Separation for more information.

2.3 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches 150 mm wide and 4 mils 0.1 mm thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches 750 mm deep; colored as follows or as required by the local utility companies:

1. Yellow: Gas, oil, steam, and dangerous materials.
2. Orange: Telephone and other communications.
3. Blue: Water systems.
4. Green: Sewer systems.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Backfill all excavations to the original surface of the ground or to such other grades as may be shown or required. For areas to be covered by exterior plantings, or lawn/meadow mix, leave or stop backfill 12 inches below the finished grade or as otherwise required to provide adequate depth of exterior plantings, or lawn/meadow mix to satisfy the requirements of Section 329300 - Exterior Plantings.

E. Obtain approval for the time elapsing before backfilling against recently constructed masonry structures. Remove from all backfill, and from the space being backfilled, any compressible, putrescible, or destructible rubbish and refuse and all lumber and braces before backfilling is started.

F. Leave sheeting and bracing in place or remove as the work progresses.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

D. Refer to Section 312319 – Dewatering.

3.3 EXACAVTION OF CONTAMINATED SOILS

A. Characterization, management, handling and disposal of contaminated materials shall be performed in conformance with the recommendations of the Limited Phase II Environmental Site Investigation (ESI)' dated June 6, 2016 and all applicable regulations.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

a. Measurements in subparagraphs below are examples only; revise to suit Project conditions and office standards.

b. 24 inches outside of concrete forms other than at footings.

c. 12 inches outside of concrete forms at footings.

d. 6 inches outside of minimum required dimensions of concrete cast against grade.

e. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

f. 6 inches beneath bottom of concrete slabs-on-grade.

g. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

B. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

C. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATIONS AT EDGES OF TREE- AND PLANT-PROTECTION ZONES:

A. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

B. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

D. Clearance: 12 inches each side of pipe or conduit.

E. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for pipe bedding course. Hand-excavate deeper for bells of pipe.

F. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.9 SUBGRADE INSPECTION

A. Notify the Commissioner when excavations have reached required subgrade.

B. If the Commissioner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill consist of sand and gravel with less than 15% silt. A 2-inch maximum size, well graded crush stone or structural fill subbase must be provided over the subgrade and/or fill as means of sub-pavement support and drainage layer.

C. Proof-roll subgrade below the building slabs and pavement with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

D. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Commissioner, and replace with compacted backfill or fill as directed.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Commissioner.

B. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Commissioner.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, and waterproofing.

2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.

4. Removing concrete formwork.

5. Removing trash and debris.

6. Removing temporary shoring and bracing, and sheeting.

7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact pipe bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete"

D. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 6" concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete"

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Place and compact initial backfill of subbase material, free of particles larger than 2 inch in any dimension, to a height of 12 inches over the pipe or conduit.

G. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under walks and pavements, use satisfactory soil material.

3. Under steps and ramps, use engineered fill.

4. Under building slabs, use engineered fill.

5. Under footings and foundations, use engineered fill.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and re-compact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.

2. Under walkways, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.

3. Under turf or unpaved areas, scarify and re-compact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

4. For utility trenches, compact each layer of initial and final backfill soil material at 98 percent.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

D. Final Contours: Perform finish grading in accordance with the completed contour elevations and grades shown on the Contract Drawings and blend into conformation with remaining natural ground surfaces.

1. For rough grading, leave all grading surfaces smooth, uniform and firm to drain. Areas shall be finished to the degree obtainable by either blade or scraper operations and suitable for application of topsoil or paving section.

2. Bring finish grades to elevations within plus or minus 0.10 foot of elevations or contours shown.

3. Areas which are anticipated to be undisturbed for a period of more than 30 days shall receive temporary seeding of rye grass at a rate of three bushels per acre, weather and season permitting, or as directed by the Commissioner. This seeding shall be repeated as necessary to maintain a continuing ground cover.

4. Refer to Detail Specification 329113 – Planting Soil Mixes for additional requirements for finish and fine grading operations.

5. Surface Drainage: Grade outside of building or structure lines in a manner to prevent accumulation of water within the area. Where necessary or where shown, extend finish grading to ensure that water will be carried to drainage ditches, and the site area left smooth and free from depressions holding water as directed by the Commissioner.

3.18 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: See Section 334600 - Subdrainage.

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

C. Compact each filter material layer to 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.

2. Place base course material over subbase course under hot-mix asphalt pavement.

3. Shape subbase course and base course to required crown elevations and cross-slope grades.

4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.

5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D698 or ASTM D 1557.

3.20 FIELD QUALITY CONTROL

A. Inspections: The City of New York will engage a qualified special inspector to perform the inspections.

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material and maximum lift thickness comply with requirements.

3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Testing: The City of New York will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

1. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

2. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Commissioner.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.

3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Scarify or remove and replace soil material to depth as directed by Commissioner; reshape and re-compact.

D. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

E. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on The City of New York's property. Stockpile or spread soil as directed by Commissioner.

B. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off The City of New York property.

3.23 CORRECTION OF WORK

A. Correction of Work: Correct any areas of unsatisfactory compaction or landforms in the Contract Drawings by removal and replacement, or by scarifying, aerating or sprinkling as needed and recompaction in place prior to placement of a new lift. The Contractor shall, if necessary, increase his compactive effort by increasing the number of passes, using heavier or more suitable compaction equipment, or by reducing the lift thickness. The Contractor shall adjust the moisture content of the soil to bring it to the optimum range by drying or adding water, as required.

B. Responsibility for after settlement: Correct any depression which may develop from settlement in backfilled areas or landforms as per the Contract Drawings within one year after the work is fully completed. Provide, as needed, backfill material, soil mix, pavement base replacement, permanent pavement, sidewalk, curb and driveway repair or replacement, and exterior plantings, and/or lawn/meadow mix replacement, and perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as approved. Transport surplus satisfactory soil to designated storage areas on The City of New York's property. Stockpile or spread soil as directed by Commissioner.

END OF SECTION 312000

This Page Intentionally Left Blank

SECTION 312316

ROCK REMOVAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to construct the improvements as shown on the Contract Drawings or as directed by the Commissioner, which include but not limited to:

1. Excavation, removal and disposal of excavated rock materials when encountered and necessary to construct the Project as proposed.

2. On-site rock crushing and reuse is permitted, refer to Commissioner for specific information for pavement subbase, structural fill subbase, pipe bedding, rip rap specifications.

3. Due to the proximity of existing structures and streets, the use of explosive is not allowed.

1.3 DEFINITION OF TERMS

A. Earth Excavation: Removal of material to lines, elevations, and dimensions shown of drawings and disposition of materials encountered in grading and excavation work except that classified as rock.

B. Rock Excavation: Removal of materials classified as rock and disposal of excavated material as specified herein and in conformity with lines, grades, and dimensions shown on drawings. To be classified as rock, material must be boulders of one-half cubic yard or more in volume, solid or ledge rock, or other hard material in place that cannot be excavated by heavy construction equipment, such as a Caterpillar 215C power excavator equipped with a short-tip radius rock bucket or a Caterpillar D9 bulldozer equipped with a single tooth hydraulic ripper or comparable. In addition, the material must exceed a value of 3 on Mohs' hardness scale. Material classified as rock shall be removed by drilling and feathering, bull point wedging, Ho-rams, power shovels, or chemical demolition agents.

1.4 EXCAVATION

A. Carry excavation through whatever materials are encountered to depths shown on drawings. Remove all existing fill, debris, unsuitable materials (unclassified materials) and rock within limits of excavation as indicated on the drawings.

B. Remove excavated material not required or not suitable for backfill from site. Dispose of excavated material off-site to disposal areas approved by the Commissioner.

C. When excavations are carried below ground water elevations, such excavations shall be dewatered by lowering and maintaining the ground water level at twelve (12) inches minimum below such excavations during all construction, including subgrade excavation, placing of reinforcing steel or pipe, placing of concrete, plastering of masonry, and shall be maintained in a dry condition until all concrete has been placed and allowed to harden for at least twelve (12) hours as specified above.

1.5 REFERENCES

A. For construction noise, the Contractor shall refer to the following standards:

1. New York City Noise Code, Chapter 28 "Citywide Construction Noise Mitigation"

2. Federal Highway Administration Noise Prediction Model b

3. OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section 650 (Subpart p - Excavations)

1.6 RELATED SECTIONS

A. Section 311000 - Site Clearing

B. Section 312000 - Earthwork

C. Section 312500 - Erosion and Sedimentation Control

1.7 INFORMATION SUBMITALS

A. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

PART 2 - PRODUCTS

2.1 NON-EXPLOSIVE DEMOLITION OF ROCK

A. Materials - The Contractor may use Soundless Chemical Demolition Agents (SCDAs) as a substitute for the use of explosives.

1. FRACT-AG, distributed by Daigh Company Inc., Cumming, GA.

2. Dexpan, as manufactured by Archer Company USA, Santa Teresa, NM.

3. Bustar, distributed by Demolition Technologies Incorporated, Greenville, AL.

B. Equipment

1. Use drilling equipment as indicated by the chemical demolition agent manufacturer or distributor.

2.2 ROCK MEASUREMENT:

A. Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.

2. 12 inches outside of concrete forms at footings.

3. 6 inches outside of minimum required dimensions of concrete cast against grade.

4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.

5. 6 inches beneath bottom of concrete slabs-on-grade.

6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

PART 3 - EXECUTION

3.1 NON-EXPLOSIVE DEMOLITION

A. Follow the manufacturer's instructions on how to drill the holes in rock and use the chemical demolition cartridges in the holes.

B. Design and execute a demolition pattern of holes at distances and depths recommended by the manufacturer.

C. Scale and remove the cracked rock immediately after the chemical agent has produced cracking. It may need several steps using chemical demolition agents to achieve the removal of rock to the required final elevation.

3.2 ROCK EXCAVATION BY HEAVY EQUIPMENT AND TOOLS

A. Noise will be a major factor in using heavy equipment in rock excavation/demolition. The Contractor shall use the quietest equipment; retrofit equipment with damping materials; use enclosures; erect barriers as necessary to mitigate the noise.

B. Portable acoustic barriers immediately surrounding drill rigs and heavy equipment and hydraulic hammers shall be provided by the Contractor.

C. For dust abatement, drill rigs or any machine causing dust shall be fitted with dust collectors and sprays to suppress dust.

D. Excavation shall not undermine existing building/structure foundation.

END OF SECTION 312316

This Page Intentionally Left Blank

SECTION 312319

DEWATERING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Geotechnical Design Report prepared for The Croton Water Treatment Plant at Mosholu Golf Course, Van Cortlandt Park, Borough of Bronx, City of New York, prepared by Metcalf & Eddy of New York, Inc & Hazen and Sawyer, P.C., dated November 2000.

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform dewatering during construction as necessary to construct and maintain the improvements as shown on the Contract Drawings or as directed by the Engineer.

1.3 RELATED SECTIONS:

A. Section 312000 - Earthwork

B. Section 312500 - Erosion and Sediment Control

C. Section 315000 – Excavation Support and Protection

D. Section 334600 – Subdrainage

1.4 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.

3. Review geotechnical report.

4. Review proposed site clearing and excavations.

5. Review existing utilities and subsurface conditions.

6. Review observation and monitoring of dewatering system.

7. Discharge the construction dewatering flow to the nearby temporary sediment basins where possible.

8. Secure the necessary permit to discharge to the nearby sewer system.

B. Dewatering: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

C. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

C. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.7 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

B. The latest Geotechnical Report prepared for this Project.

C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1.8 REFERENCES

A. State of New York Department of Environmental Conservation (NYSDEC) General Discharge Permit

B. International and New York City Building Code

C. ASTM standards applicable to piping, equipment and other items required for a complete dewatering system.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Provide dewatering system, including comprehensive engineering analysis by a qualified professional engineer.

C. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.

D. Prevent surface water from entering excavations by grading, dikes, or other means.

E. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

F. Remove dewatering system when no longer required for construction.

G. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

B. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.

C. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

D. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

E. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

F. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

G. Provide temporary grading to facilitate dewatering and control of surface water.

H. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 311000 "Site Clearing," during dewatering operations.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Space well points or wells at intervals required to provide sufficient dewatering.

C. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

D. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

E. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

3.3 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

C. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

E. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

F. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

G. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

3.4 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

D. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

E. Survey-Work Benchmarks: Resurvey benchmarks monthly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Commissioner if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

F. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

G. Provide periodic testing of Radon level in groundwater and air during contruction or as directed by the Commissioner.

H. Prepare reports of observations.

3.5 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused by dewatering.

END OF SECTION 312319

SECTION 312500

EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The Work specified in this Section consists of the labor, equipment, tools, materials and services needed to manage stormwater and provide and maintain temporary and permanent erosion control measures prior to and throughout construction as described herein, shown on the Contract Drawings or as directed by the Commissioner. Work in this Section includes, but is not limited to:

1. A Trained Contractor to prepare and/or renew the Stormwater Pollution Prevention Plan (SWPPP) for this project.
2. Comply with the conditions and requirements set forth in the General Permit for Stormwater Discharges from Construction Activity Permit GP-0-10-001 approved for this Project.
3. Submit Notice of Intent (NOI).
4. Coordination with the Commissioner regarding NYCDEP and NYSDEC requests pertaining to erosion and sedimentation control.
5. Installation and maintenance of temporary and permanent sedimentation and erosion control measures.
6. Maintain existing sediment basins and construct new sediment basins during construction.
7. Construct temporary drainage swale to convey stormwater to sediment basins.
8. Control of erosion from stockpiles.
9. Perform weekly Inspections by a Qualified Inspector of erosion control measures during and after rainfall and prepare reports.
10. Repair of failed sedimentation and erosion control measures.
11. Removal and disposal of sediment deposits in a manner that does not result in additional erosion or pollution.
12. Removal of temporary erosion control measures once construction and permanent stabilization is complete.
13. Update the SWPPP when necessary.

14. Maintain and make available for public viewing the SWPPP report, site inspection report, NOI certificates and the GP-0-10-001 permit.

1.3 PERMITTING

A. The Contractor shall renew the SPDES General Permit for Stormwater Discharges During Construction Activity as in accordance with the requirements for GP-0-10-001permit.

1.4 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A. The SWPPP shall be amended to identify any new Contractor or Subcontractor that will implement any measures of the SWPPP which shall be updated as required.

B. The Prime Contractor and the Subcontractor implementing any measures of the SWPPP will be required to sign a certification statement in the SWPPP and the Erosion and Sediment Control Plan (ESC) must sign the "Contractor/Subcontractor SPDES Certification" before commencing any construction activity at the site.

1.5 RELATED SECTIONS

A. Section 311000 – Site Clearing

B. Section 312000 – Earthwork

C. Section 312316 – Rock Removal

D. Section 312319 – Dewatering

E. Section 315000 – Excavation Support & Protection

F. Section 329301 – Tree Protection

1.6 RELATED REQUIREMENTS

A. ASTM D 3786 - Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method

B. ASTM D 4354 - Sampling of Geosynthetics for Testing

C. ASTM D 4355 - Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)

D. ASTM D 4439 - Standard Terminology for Geotextiles

E. ASTM D 4491 - Water Permeability of Geotextiles by Permittivity

F. ASTM D 4533 - Trapezoid Tearing Strength of Geotextiles

G. ASTM D 4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles

H. ASTM D 4751 - Method for Determining Apparent Opening Size of a Geotextile

I. ASTM D 4759 - Method for Determining the Specification Conformance of Geosynthetics

J. ASTM D 4873 - Method for Identification, Storage, and Handling of Geotextiles

K. ASTM D 1556 - Density and Unit Weight of Soil in Place by the Sand-Cone Method

L. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb Hammer and 18-in. Drop

M. ASTM D 2922 - Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

N. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings

O. OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section 650 (Subpart p - Excavations)

1.7 PERFORMANCE REQUIREMENTS

A. Contractor shall comply with all applicable Federal, State, and Local codes, ordinances, regulations, statutes and standards.

B. Conform to all erosion and sedimentation control requirements per New York Standards and Specifications for Erosion and Sediment Controls by NYS Department of Environmental Conservation (NYS DEC).

C. Install temporary erosion and sediment control measures as one of the first steps of site preparation, before any clearing and grubbing or earthwork occurs. Temporary erosion and sediment control measures shall be maintained throughout the construction, and shall not be removed until permanent cover is completely established and stabilized, with no visible unstable rills or erosion, subject to the approval of the Commissioner.

D. The Contractor shall install, inspect, maintain, and modify control measures as required by changing remedial construction needs over time.

E. The Contractor shall plan and execute the Work to minimize routing of storm or flood water over disturbed areas in order to minimize erosion and sedimentation to the extent practicable. Similarly, the control measures shall minimize, to the extent practicable, the flow of stormwater over ground such that rills or unplanned ditches are not formed.

1.8 EROSION CONTROL MEASURES

A. Temporary and permanent soil erosion and sediment control measures including but not limited to:

1. Temporary Seeding and Stabilization
2. Dust Control
3. Rip Rap Slope Protection
4. Straw Bales
5. Silt Fence

6. Temporary Swale
7. Storm Drain Inlet Protection
8. Stone Check Dams
9. Temporary Sediment Basin
10. Stabilized Construction Entrance
11. Rip Rap Outlet Protection
12. Construction Entrance Stabilization
13. Inlet Protection
14. Lined Waterway
15. Land Grading
16. Runoff Diversion
17. Dewatering
18. Temporary Sediment Trap

1.9 SUBMITTALS

A. Stormwater Pollution Prevention Plan (SWPPP)

1. The Contractor shall comply with the Storm Water Pollution Prevention Plan (SWPPP) prepared pursuant to New York State Department of Environmental Conservation (NYSDEC) and New York City Department of Environmental Protection (NYCDEP) requirements, and in compliance with the SPDES General Permit.

2. A SWPPP shall be developed and submitted to the Commissioner for approval prior to the initiation of construction activities. The SWPPP shall include the following at a minimum:

3. Provide background information about the scope of the project, including the location, type and size of project.

4. Provide a site map for the project, including a general location map. The site map should show the total site area; all improvements; areas of disturbance; areas that will not be disturbed; existing vegetation; adjacent off-site surface water(s), wetlands and drainage patterns that could be affected by the construction activity; existing and final slopes; locations of off-site material, waste, borrow or equipment storage areas; and location (s) of the stormwater discharge(s).

5. Provide a description of the soil(s) present at the site.

6. Provide a construction phasing plan describing the intended sequence of construction activities, including clearing and grubbing, excavation and grading, utility and infrastructure installation and any other activity at the site that results in soil disturbance. Consistent with the New York Guidelines for Urban Erosion and Sediment Control, there shall not be more than five (5) acres of disturbed soil at any one time without prior written approval from NYSDEC.

7. Provide a description of the pollution prevention measures that will be used to control litter, construction chemicals and construction debris from becoming a pollutant source in the storm water discharges.

8. Provide a description of construction and waste materials expected to be stored on-site with updates as appropriate, and a description of controls to reduce pollutants from these materials including storage practices to minimize exposure of the materials to storm water, and spill prevention response.

9. Describe the temporary and permanent structural and vegetative measures to be used for soil stabilization, runoff control and sediment control for each stage of the project from initial land clearing and grubbing to project close-out.

10. Identify and show on a site map the specific location(s), size(s), and length(s) of each erosion and sediment control practice.

11. Provide the dimensions, material specifications, and installation details for all erosion and sediment control practices, including the siting and sizing of any temporary sediment basins.

12. Identify temporary practices that will be converted to permanent control measures;

13. Provide an implementation schedule for staging temporary erosion and sediment control practices, including the timing of initial placement and the duration that each practice should remain in place.

14. Provide a maintenance schedule to ensure continuous and effective operation of the erosion and sediment control practices.

15. Provide the name(s) of the receiving water(s).

16. Provide a delineation of SWPPP implementation responsibilities for each part of the site.

17. Provide a description of structural practices to divert flows from exposed soils, store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site to the degree attainable.

18. Provide any existing data that describes the stormwater runoff characteristics at the site.

19. Enforcement of documentation and repair activities as noted in the SWPPP shall be by the Signatory of the SWPPP, who shall be a designated representative of the Contractor.

20. The SWPPP shall be updated monthly to reflect changed site conditions or when directed by the Commissioner. The SWPPP and all inspection reports shall be maintained in a log book at the site. A monthly summary of the site inspection activities shall be provided to the Commissioner and added to the SWPPP.

B. Weekly SPDES Stormwater Inspection Reports

1. Following commencement of construction, site inspections shall be conducted by a Qualified Inspector the at least every seven (7) calendar days. During each inspection the qualified professional shall record the following information:

2. Date and time of inspection

3. Name and title of person(s) performing the inspection.

4. Weather description, soil conditions at time of the inspection.

5. On a site map, indicate the extent of all disturbed site areas and drainage pathways during the inspection. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period;

6. A description of natural surface water bodies located within or immediately adjacent to the property boundaries of the construction site which receive runoff from disturbed areas.

7. Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization;

8. A description of the condition of the runoff at all points of discharge from the construction site.

9. Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period;

10. Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of the sediment storage volume (for example, 10 percent, 20 percent, or 50 percent). All sediment removed from control practices shall be disposed of in accordance with all applicable regulations and in such a manner as transport of sediments does not re-occur.

11. Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (earthen berms or silt fencing) and containment systems (sediment basins and sediment traps). Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water; and

12. Identify all erosion and sediment control practice that need repair, maintenance, or not install property, or are not functioning as designed, or in need to be reinstalled, replaced or redesigned.

13. Include digital color photographs (with date stamp) in each weekly report of all practices that are in need of corrective actions, and showing the practices after corrective actions have been completed.

14. All inspection reports must be signed by the Qualified Inspector.

C. INSPECTION NOTIFICATION

1. Within one (1) business day of the inspection, the Qualified Inspector shall notify the Commissioner and Contractor of any corrective action that need to be taken. The Contractor shall begin implementing the corrective actions writing one (1) business day of the notification and complete them in a reasonable time frame.

D. ON-SITE RECORDS

1. The Notice of Intent (NOI), Stormwater Pollution Prevention Plan (SWPPP) and the weekly inspection reports required for this Project site are public documents, that the Commissioner or operator must make available on-site for review and copying by any person within five (5) business days of the Commissioner or operator receiving a written request by any such person to review the NOI, SWPPP or inspection reports. Copying of documents will be done at the requester's expense.

E. LEED SUBMITTAL REQUIREMENTS

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

   a. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

   b. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

   c. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

   d. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

3. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of theCommissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.10 PROJECT AND SITE CONDITIONS

A. The Contractor shall carefully examine the site to determine the full extent, nature, and location of work required to conform to the Contract Drawings and Specifications. The Contractor shall bring any inaccuracies or discrepancies between the Contract Drawings and Specifications to the Commissioner's attention in order to clarify the exact nature of the Work to be performed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw Bales:

1. Straw for straw bales shall meet the requirements of NYSDOT 713-19 – Straw. The use of hay is not permitted.

2. Stakes for straw bale use shall be re-bar, steel pickets or 2 inch by 2 inch hardwood.

B. Silt Fences:

1. Meet the requirements of NYSDOT 209-2.06 Silt Fence-Temporary and Table 737-01G.

2. Fence posts shall be 5 ft minimum length and be of wood or steel. Softwood posts shall be at least 1-1/2 inch by 3-1/2 inch; hardwood posts shall be at least 1-1/4 inch by 1-1/4 inch; steel posts shall be of T or U cross-section, with a minimum weight of 1.3lb/ft.

3. Fasteners shall be heavy duty staples, hog rings, tie wires or other fasteners compatible with the fence post material.

4. Silt Fence geotextile shall have a minimum permittivity of 0.05 sec-1 and a maximum Apparent Opening Size of 0.0236 inch or sieve designation of #30. The filter cloth shall be either Filter X, Mirafi 100X, Stablinka T140N, or approved equivalent.

C. Temporary Check Dams:

1. The primary purpose of a check dam is to reduce flow velocity in a channel, thereby reducing erosion in the channel. A check dam will capture sediment that falls out of

suspension behind it due to decreased velocity. A check dam is not intended to and generally does not filter sediment from turbid water.

2. The maximum drainage area for any temporary check dam shall be 2 acres.

D. Inlet Protection:

1. Inlet protection sack is a temporary sediment control devise for catch basins. It is made of woven polypropylene geotextile using a high strength nylon thread to create a filtering sack to prevent silt and sediment from entering the drainage system.

2. Inlet protection sack Styles:

   a. High Flow: ASTM D-4884, flow rate 150 gal/min./ft^2
   b. Low Flow: ASTM D-4884, flow rate 40 gal/min./ft^2

3. Inlet protection sack Types:

   a. Type A for inlet without curb piece.
   b. Type B for inlet with curb piece.
   c. Type C for adjustable frame size.

4. Contractor to provide all high flow silk sacks and the appropriate type to best fit the drainage inlets and catch basins.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. The Contractor shall provide all means, methods, services, facilities, power, equipment, tools, material, consumables, incidentals, labor and supervision necessary to manage stormwater and implement and maintain erosion and sedimentation control measures to effectively minimize erosion and sedimentation.

B. Construction, including but not limited to clearing, grubbing, earthwork and excavations shall be conducted in such a manner as to minimize erosion and sedimentation.

C. Install erosion and sedimentation control products in accordance with manufacturers' recommendations prior to any major soil disturbances, or in their proper sequence and maintained until permanent protection is established.

D. Erosion and sedimentation control measures shall be inspected by the Contractor daily. Repairs shall be made as soon as practical.

E. Cover staged soil piles with temporary liners when precipitation is expected in order to minimize soil erosion.

F. Employ, construct, inspect, maintain and document all temporary erosion and sediment control measures in accordance with the New York State Standards and Specifications for Erosion and Sediment Control, (Latest Version).

G. If the planned measures do not result in effective control of erosion and sediment runoff, the Contractor shall immediately adjust the program and/or institute additional measures in order to eliminate excessive erosion and sediment runoff.

H. Conduit Outlet Protection must be installed at all required outfalls prior to the drainage system becoming operational.

I. Contractor is responsible for keeping all adjacent roads clean during life of construction project.

3.2 TEMPORARY AND PERMANENT SEEDING AND STABILIZATION

A. Any disturbed areas that will be left exposed more than 30 days and not subject to construction traffic, shall immediately receive a temporary seeding. If the season prevents the establishment of a temporary cover, the disturbed areas shall be mulched with straw or equivalent material, at a rate of two (2) tons per acre, according to NYS DEC standards.

B. Permanent Vegetation shall be seeded or sodded on all exposed areas within ten (10) days after final grading. Mulch will be used for protection until seeding is established

C. A sub-base course will be applied immediately following rough grading and installation of improvements in order to stabilize streets, roads, driveways and parking areas. In areas where no utilities are present, the sub-base shall be installed within 15 days or preliminary grading.

D. Immediately following initial disturbance or rough grading all critical areas subject to erosion (i.e.: steep slopes, roadway embankments) will receive a temporary seeding in combination with straw mulch or a suitable equivalent, at a rate of two (2) tons per acre, or as in accordance with the NYS DEC requirements.

E. Any slopes greater than 3:1which receive pipeline installation will be backfilled and stabilized daily.

F. Install stabilized construction entrance with a minimum 50 feet long x 24 feet wide x 6" thick pad of 1" to 4" stones, immediately after initial site disturbance.

G. At the time when the site preparation for permanent vegetative stabilization is going to be accomplished, any soil that will not provide a suitable environment to support adequate vegetative ground cover, shall be removed or treated in such a way that will permanently adjust the soil conditions and render it suitable for vegetative ground cover. If the removal or treatment of the soil will not provide suitable conditions, non-vegetative means of permanent ground stabilization will have to be employed.

3.3 DUST CONTROL

A. Dust control measures shall be implemented as needed, including, but not limited to, those items when visible dust is generated during the clearing, demolition, earthwork and construction vehicle cleaning.

B. Provide air monitoring during earthwork operations (mass excavation, backfilling, and grading operations), as per local regulatory requirements.

3.4 RIP RAP

A. The Contractor shall place rip rap as shown, noted, and detailed on the Contract Drawings. Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular in shape. The least dimension of an individual rock shall be not less than one-third the greatest dimension of that fragment. The stone shall be of such quality that it will not disintegrate on exposure to water or weathering, be chemically stable, and shall be suitable in all other respects for the purpose intended. The bulk specific gravity (saturated surface-dry basis) of the individual stones shall be at least 2.65.

3.5 STRAW BALES

A. Straw bale sediment barriers are only to be used when:

1. No other practice is feasible.

2. Erosion would occur in the form of sheet erosion.

3. The length of slope above the bales does not exceed the following limits for a one-inch rainfall event:

a. 2:1 slope 25 ft slope length
b. 3:1 slope 50 ft slope length
c. 4:1 slope 75 ft slope length

B. Bales shall be placed at the toe of a slope or along a contour with each vertical end tightly abutting the adjacent bale. Loose straw shall be wedged between bales as required.

C. Each bale shall be embedded a minimum of 4 inches and placed so bindings are horizontal.

D. Two stakes shall securely anchor each bale in place. Stakes must be driven a minimum of 18 inches into the ground and driven flush with the top of the bale. The first stake in each bale shall be driven at an angle toward the previously laid bale, in order to force the bales together.

3.6 SILT FENCE

A. Silt fences shall be placed within 2 ft of the area under consideration, but at least 10 ft from the toe of a slope to allow for maintenance and roll down of larger materials from the slope.

B. The geotextile shall be embedded to a minimum of 6 inches with native material tamped in place so that no flow can pass under the fence.

C. The geotextile shall be placed on the upslope side of the fence posts.

D. Where ends of the geotextile join each other, they shall be overlapped by a minimum of 6 inches, folded and stapled or sewn.

E. Geotextile shall be securely fastened to reinforced support with ties spaces every 24 inches at the top and mid-section.

F. The fence post shall be driven a minimum of 2 ft into the ground. Maximum center to center fence post spacing shall be 4 ft. Reinforced support shall be a minimum 30 inches high and tied to fence posts.

3.7 TEMPORARY SWALES

A. Contractor to construct temporary swales and stone check dams to divert surface water runoff to the sediment basin and minimize construction water washout the sediment to outside of the construction limits or to the adjacent streets.

1. The drainage area for a temporary dike/swale shall be less than 2 acres.

2. The evenly divided minimum height from the bottom of the swale to the top of dike shall be 24 inches.

3. The top width of the swale shall be a minimum of 2 feet. The bottom of the swale shall have a minimum slope of 0.5% and a maximum slope of 5%. The side of the swale shall be maximum 3H:1V slope. The entire bottom of the swale should lined with erosion control blanket SC150B, made by North American Green or equivalent.

4. The bottom width of the dike shall be a minimum of 2 feet,

5. The perimeter dike/swale shall have positive drainage to an adequate stabilized outlet with a maximum allowable grade of 8 percent.

6. Erosion control products shall be installed within the ditches to minimize soil erosion.

7. Diverted runoff from a disturbed area shall convey to a sediment trapping device or an area protected by a sediment trapping device.

8. Periodic inspection and maintenance must be carried out following any rain event at a minimum.

3.8 TEMPORARY CHECK DAMS

A. Contractor to construct temporary check dams where needed to control the runoff velocity in the swale and reduce erosion.

1. Materials

a. Stone fill core material shall meet the graduation requirements for drainage course per Section 312000 - Earthwork.

b. Aggregate facing material shall meet the graduation requirements for Size Designation #1 or #2 from NYSDOT Table 703-4.

c. Check dams shall be keyed into the channel by a cutoff trench 20" wide and 8" deep.

d. Sand/gravel bags may be substituted for stone. Bags must be filled with clean sand/gravel to prevent receiving waters from becoming turbid.

e. If sand/gravel bags are used, they must be individually tied, double bagged and inversely inserted. Bags shall lap the joints between the bags in the layer below.

f. If stone check dams are constructed, the stone shall be placed on a geotextile to prevent soil migration.

2. Maintenance Requirements:

a. Inspect channel every 7 days, after each rainfall event of minimum 0.5 inches over a 24 hour period, or daily during prolonged rainfall. Clean and repair as required.

b. If significant erosion occurs between check dam structures, a stone liner or Rolled Erosion Control Product (RECP) should be installed in that portion of the channel.

c. Remove sediment when accumulation reached half of the channel height. Removed sediment shall be managed such that it does not create erosion and sediment issues. If it is considered to be a contaminated material, then it shall be disposed of as per Section 022423 – Chemical Sampling and Analysis of Soils.

d. Replace stones, sand/gravel bags as required to maintain the design cross-section of the check dams.

3.9 RIP RAP APRON OUTLET PROTECTION

A. Install rip rap apron outlet protection at the outlet pipes to reduce erosion and scouring, and to reduce velocity and energy of discharge at a receiving reach.

B. Outlets protection shall be installed as per the latest version of the New York State Standards and Specifications for Erosion and Sediment Control.

3.10 CONSTRUCTION ROAD STABILIZATION

A. A 6 inch layer of Structural Fill as per Section 312000 – Earthwork, shall be placed evenly over the full width of the temporary construction route.

B. Surface drainage will be provided and excess runoff shall be diverted to stabilized areas. Roadside ditch capacity shall be the 10 yr. peak runoff where required.

C. Construction Roads shall be top-dressed with new gravel as required.

3.11 STABILIZED CONSTRUCTION ENTRANCE

A. The length of the stabilized construction entrance shall be a minimum of 50 feet.

B. The width shall be 12 foot minimum, but not less than the full width where ingress or egress occurs. For a single site entrance, this shall be a minimum of 24 feet.

C. A stabilization geotextile or filter fabric, as per Section 313219 – Geosynthetic Soil Stabilization & Layer Separation, shall be placed over the entire area before gravel placement. This will also serve as a suitable separation fabric.

D. A minimum of 6 inches of 2" to 3" coarse aggregate gravel shall be placed over the geotextile.

E. The entrance shall be maintained in a condition which will prevent tracking of sediment onto public streets, including top-dressing as required.

3.12 INLET PROTECTION

A. To install Inlet protection sediment trap in the catch basin, remove the grate and place the sack in the opening. Hold approximately six inches of the sack outside the frame. This is the area of the lifting straps. Replace the grate to hold the sack in place.

B. When the restraint cord is no longer visible, Inlet protection sack is full and should be emptied.

C. To remove Inlet protection sack, take two pieces of 1" diameter rebar and place through the lifting loops on each side of the sack to facilitate the lifting of Inlet protection sack. To empty Inlet protection sack, place unit where the contents will be collected. Place the rebar through the lift straps (connected to the bottom of the sack) and lift. This will lift Inlet protection sack from the bottom and empty the contents. Clean out and rinse. Return Inlet protection sack to its original shape and place back in the basin.

D. Inlet protection sack is reusable. Once the construction cycle is complete, remove Inlet protection sack from the basin and clean, stored out of sunlight until next use.

END OF SECTION 312500

SECTION 313219

GEOSYNTHETIC SOIL STABLIZATION AND LAYER SEPARATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall furnish and install Geotextile Fabric, including all necessary and incidental items required to complete the installation in accordance with the Drawings and as specified herein.

B. For the location of each type of Geotextile Fabric, see the Drawings.

1.3 RELATED SPECIFICATIONS

A. Section 312000 - Earthwork

B. Section 312500 – Erosion and Sedimentation Control

C. Section 334600 – Subdrainage

1.4 REFERENCES

A. ASTM D5261 – Mass Per Unit Area

B. ASTM D5199 – Thickness

C. ASTM D4632 – Grab Tensile Strength

D. ASTM D3786 – Burst Strength

E. ASTM D4833 – Puncture Resistance

F. ASTM D4355 – UV Resistance

G. ASTM D4491 – Permittivity

H. ASTM D4751 – Apparent Opening Size

1.5 SYSTEM DESCRIPTION

A. Geotextile Fabric shall be placed to the lines and grades shown on the Drawings for use as a filter, cushion, or separator between differing construction materials as called out on the Drawings or as specified herein.

1. Filter Geotextile shall produce an equilibrium geotextile-to-soil system that allows for adequate liquid flow with limited soil loss through the geotextile.

2. Cushion Geotextile shall provide a cushion from the installation of one construction material above another construction material, with the purpose of protecting the lower and/or upper material from damage.

3. Separator Geotextile shall act as a flexible, porous textile placed between dissimilar materials such that the integrity and functioning of both materials shall remain intact or be improved.

1.6 SUBMITTALS

A. Prior to shipping to the site, the Contractor shall submit to the Commissioner two copies of mill certificates or affidavits signed by a legally authorized official of the manufacturer for each type of Geotextile fabric. The Contractor shall also submit three geotextile fabric samples of each product, 1 yard square each, seamed and un-seamed as appropriate, with the mill certificate for each geotextile fabric type supplied. The mill certificate or affidavit shall attest that the geotextile fabric meets the chemical, physical and manufacturing requirements stated in this Detailed Specification. The samples shall be labeled with the manufacturer's lot number, machine direction, date of sampling, project number, specifications, manufacturer and product name.

B. The Commissioner shall be furnished copies of the delivery tickets or other acceptable receipts as evidence for materials received that will be incorporated into the work.

C. The Contractor shall be responsible for timely submittals of all confirmation test data for Geotextile Fabrics prior to approval for use in the Work.

D. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each

product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.7 QUALITY ASSURANCE AND QUALIFICATIONS

A. At the option of the Commissioner, representative samples of Geotextile Fabrics shall be obtained and tested by the Commissioner to assure that the material properties conform to this Detailed Specification.

B. Conformance testing shall be completed at a minimum frequency of one sample per 100,000 square feet of Geotextile Fabric delivered to the project site. Sampling and testing shall be as directed by the Commissioner.

C. Conformance testing of the Geotextile Fabrics shall include but not be limited the properties noted in this Detailed Specification.

D. The Commissioner may add to, remove or revise the test methods used for determination of conformance properties to allow for use of improved or more technically applicable methods.

E. All Geotextile Fabric conformance test data shall meet or exceed requirements outlined in Table 1 at the end of this Specification for the particular type of Geotextile Fabric

prior to installation. Any materials that do not conform to these requirements shall be retested or rejected at the direction of the Commissioner.

F. Each roll of Geotextile Fabric will be visually inspected by the Commissioner. The Commissioner reserves the right to sample, test and reject, if necessary, Geotextile Fabric based on visual inspection or verification tests.

G. A Geotextile Fabric that is rejected shall be removed immediately from the project site and replaced at the Contractor's expense. Sampling and conformance testing of the Geotextile Fabric supplied as replacement for rejected material shall be performed by the Commissioner at Contractor's expense.

1.8 DELIVERY STORAGE AND HANDLING

A. During all periods of shipment and storage, Geotextile Fabrics shall be protected from direct sunlight, temperature greater than 140 °F water, mud, dirt, dust, and debris.

B. To the extent possible, the Geotextile Fabric shall be maintained wrapped in heavy-duty protective covering until use. Geotextile Fabric delivered to the project site without protective covering shall be rejected. After the protective covering has been removed, the Geotextile Fabric shall not be left uncovered for longer than 3 days, under any circumstances.

C. The Commissioner shall approve the shipping and delivery schedule prior to shipment. The Commissioner shall designate the on-site storage area for the Geotextile Fabric. Unloading and proper storage of Geotextile Fabrics shall be the responsibility of the Contractor.

D. Geotextile Fabrics that are damaged during shipping or storage shall be rejected and replaced at Contractors expense.

PART 2 PRODUCTS

2.1 FILTER GEOTEXTILE FABRIC

A. Filter Geotextile shall be a minimum 8-ounce per square yard nonwoven needle-punched synthetic fabric consisting of staple or continuous filament polyester or polypropylene. The Filter Geotextile shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH range from 3 to 10. The Filter Geotextile shall have a minimum threshold water head of 0.25-inches in the "as received" condition.

B. Filter Geotextile shall be one of the following products or "as equal" as approved by the Commissioner:

1. Mirafi S800 manufactured by Mirafi Construction Products,
2. SKAPS GE-170 manufactured by Engineered Synthetic Products, Inc.
3. Propex 4508 manufactured by Amoco Fabrics and Fibers, Inc.
4. For planting and soil installation, Mirafi 140NL manufactured by Mirafi Construction Products

2.2 CUSHION GEOTEXTILE FABRIC

A. Cushion Geotextile shall be a minimum 16-ounce per square yard nonwoven needle-punched synthetic fabric consisting of continuous filament or staple polyester or polypropylene. Cushion Geotextile shall be inert and unaffected by long-term exposure to chemicals or liquids with a pH range from 3 to 10.

B. Cushion Geotextile shall be one of the following products or "as equal" as approved by the Commissioner:

1. Mirafi S1600 manufactured by Mirafi Construction Products,
2. SKAPS GT-116 manufactured by Engineered Synthetic Products, Inc.
3. Propex 4516 manufactured by Amoco Fabrics and Fibers, Inc.

2.3 SEPARATOR GEOTEXTILE FABRIC

A. Separator Geotextile shall be a woven slit film or monofilament synthetic fabric consisting of polyester or polypropylene.

B. Separator Geotextile shall be one of the following products or "as equal" as approved by the Commissioner:

1. GTF 400E manufactured by LINQ Industrial Fabrics, Inc.,
2. Geotex 104F manufactured by Synthetic Industries, Inc.,
3. Propex 1199 manufactured by Amoco Fabrics and Fibers, Inc.

PART 3 EXECUTION

3.1 INSTALLATION

A. Geotextile Fabrics shall be placed to the lines and grades shown on the Drawings. At the time of installation, the Geotextile Fabric may be rejected by the Commissioner if it has defects, rips, holes, flaws, evidence of deterioration, or other damage.

B. The Geotextile Fabrics shall be placed smooth and free of wrinkles determined to be excessive by the Commissioner.

C. When the Geotextile Fabrics are placed on slopes, the upslope fabric portion shall be lapped such that it is the upper or exposed Geotextile Fabric.

D. Geotextile Fabrics shall be temporarily secured in a manner acceptable to the Commissioner prior to placement of overlying materials. The Contractor shall be responsible for repair or replacement of any Geotextile damaged due to the effects of wind, water or sediment during construction.

E. Filter or Separator Geotextile fouled by sediment during construction shall be removed and replaced by the Contractor if, in the opinion of the Commissioner, filter or separation function of the Geotextile is compromised.

F. The minimum overlap of adjacent rolls of Geotextile Fabric shall be as follows:

GEOTEXTILE TYPE/ APPLICATION	OVERLAP OF ADJACENT ROLLS [1] (INCHES)	TRANSVERSE END OVERLAP (INCHES)
Filter Geotextile	6 min	12 min
Cushion Geotextile	12 min	12 min
Separator-Roadway Applications[2]	12 min	24 min
Separator-Slope Protection[2]	18 min	24 min
Special Applications	(2)	(2)

[1] Overlaps may be reduced if adjacent panels are sewn or heat bonded where approved by the Commissioner.

[2] Special applications may require additional overlap, sewing or other mechanical connection. Special applications are shown on the Drawings.

G. Geotextile shall be off limits to vehicle or construction traffic. Any damage due to vehicle traffic shall be repaired by the Contractor at no cost to the City of New York.

H. Any Geotextile Fabric that is torn or punctured shall be repaired or replaced as directed by the Commissioner at no additional cost to the City of New York. The repair shall consist of a patch of the same type of Geotextile Fabric placed over the failed areas and shall overlap the existing Geotextile Fabric a minimum of 12-inches from any point of the rupture.

I. The Contractor shall not cause damage to Geotextiles during placement or compaction of overlying materials. During placement of aggregate over any Geotextile, drop height shall be limited to 3-feet for aggregate less than 4-inches in diameter and to less than 1-foot for rip-rap or any aggregate greater than 4-inches in diameter. Construction materials or methods may have to be modified to prevent damage to Geotextiles.

(See Table 1 on the next page)

TABLE 1 - MINIMUM REQUIRED GEOTEXTILE PROPERTIES*

GEOTEXTILE FABRIC PROPERTY	FILTER GEOTEXTILE	CUSHION GEOTEXTILE	SEPARATOR GEOTEXTILE
Geotextile Construction	Nonwoven Needle punched	Nonwoven Needle punched	Woven
Mass per Unit Area (Unit Weight), ASTM D5261 (oz/yd^2)	7.5	15.7	5.6
Ultraviolet Resistance, (500 hrs.) ASTM D4355, Average % Strength Retention	70	70	90
Grab Tensile Strength (lbs.), ASTM D4632	200	340	370 (1) X 250 (2)
Grab Tensile elongation (%) ASTM D4632	50	50	20 Max
Burst Strength, ASTM D3786, Diaphragm Method (psi)	380	500	450
Apparent Opening Size (AOS), (mm), ASTM D4751	0.21	N/A	0.21
Permittivity at 50 mm constant head (sec^{-1}), ASTM D4491	1.3	N/A	N/A
Puncture Resistance, ASTM D4833 (lb)	120	200	120

* MINIMUM AVERAGE ROLL VALUE (MARV)
(1) Warp Direction
(2) Fill Direction

END OF SECTION 313219

This Page Intentionally Left Blank

SECTION 315000

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Geotechnical Report prepared for The Croton Water Treatment Plant at Mosholu Golf Course, Van Cortlandt Park, Borough of Bronx, City of New York, prepared by Metcalf & Eddy of New York, Inc & Hazen and Sawyer, P.C., dated November 2000.

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform excavation, backfill, trenching, compaction, and paving, as necessary to construct temporary excavation support and protection systems necessary for the improvements as shown on the Contract Drawings or as directed by the Commissioner.

B. Related Sections:

1. Section 312000 - Earthwork
2. Section 312319 – Dewatering
3. Section 334610 – Stormwater Underground Detention

C. Related References:

1. ASTM D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
2. Geotechnical Report

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

C. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.

D. Include plans, elevations, sections, and details.

E. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.

F. Indicate type and location of waterproofing.

G. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Existing Conditions: Using photographs, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

C. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.5 FIELD CONDITIONS

A. Notify Construction Manager no fewer than two days in advance of proposed interruption of utility. Do not proceed with interruption of utility without Commissioner's written permission.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Commissioner is not responsible for interpretations or conclusions drawn from the data.

C. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements. Review the project Geotechnical Report.

D. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide, design, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting earth and hydrostatic pressures and superimposed and construction loads.

B. Engineering Services: Engineer excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer. Prevent surface water from entering excavations by grading, dikes, or other means. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

2.2 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 4 inches.

D. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

E. Reinforcing Bars: ASTM A 615/A 615M, Grade 60Grade 420, deformed.

F. Tiebacks: Steel bars, ASTM A 722/A 722M.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

B. Shore, support, and protect utilities encountered.

C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

D. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Commissioner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

E. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

3.2 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches50 mm) from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.3 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

C. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

D. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.4 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks regularly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.

C. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

3.5 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

B. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.

C. Fill voids immediately with approved backfill compacted to density specified in Section 312000 "Earthwork".

D. Repair or replace, as approved by Commissioner, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 320516

AGGREGATE PAVING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Peastone Paving.

2. Rounded Gravel in the Wetland Cells

1.3 RELATED SECTIONS

A. Sustainability Requirements – Section 013010

B. Geosynthetic Soil Stabilization And Layer Separation – Section 313219

C. Earthwork – Section 312000

D. Planting Soil Mixes – Section 329113

E. Soil Mixes for Wetland Areas – Section 327500

F. Exterior Plantings – Section 329300

G. Plantings for Wetland Areas – Section 327200

H. Vegetated Roofing System – Section 073360

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed Gravel and Peastone with edging installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of sucessful in-service performance.

B. Source Limitation: Obtain each type of aggregate paving from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on the Project site during times the installation is in progress.

D. Mockups: Before installing Gravel and Peastone, build mockups for each type and application required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work, including same base construction, specified edging, and contiguous Work as indicated:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by the Construction Manager and the Landscape Architect. Unless otherwise specified the mockup shall be a minimum size of 6' x 6' x full depth for each time and application.

2. Notify Construction Manager and Landscape Architect seven days in advance of dates and times when mockups will be constructed.

3. Demonstrated the proposed range of aethetic effects and workmanship.

4. Obtain the Construction Manager and the Landscape Architect's approval of mockups before starting installation of work.

5. Maintain mockup during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups when directed.

7. Approved mock ups may not become part of the completed Work unless authorized by Landscape Architect.

1.5 PERFORMANCE REQUIREMENTS

A. The following standards and definitions are applicable to the work of this Section to the extent referenced herein:

1. Standard Specifications: The City of New York Department of Transportation Highway Department, Standard Specification, latest edition.

2. ASTM: American Society for Testing and Materials.

3. AASHTO: American Association of State Highway and Transportation Officials.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Aggregate Paving shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Specification section 013010 Project Specific Sustainability Requirements.

B. Aggregate Paving materials fabricated within and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Specification section 013010 Project Specific Sustainability Requirements.

1.7 SUBMITTALS

A. Product Data:

1. Product Data: For each type of product indicated

2. Sieve analysis of aggregate for each type of product indicated

B. Samples for Verification:

1. 12-inch baggies of each type of aggregate indicated; in sets for each color, texture, and pattern specified, showing the full range of variations. Clearly label each bag of each paving type.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. LEED Submittal Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or sub-contractor's work. Cost breakdowns shall included total installed cost and material-only cost.

b. The percentage (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of the exact distance (in miles) from the location of where the products(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g. recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.8 DELIVERY, STORAGE, AND PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Deliver, store and handle as directed by Construction Manager.

1.9 PROJECT CONDITIONS

A. Stockpiling: Aggregates materials, stored on Project Site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All stockpiled materials shall be placed on tarpaulin, heavy polyethylene sheeting or other suitable barrier to protect park surfaces from soiling by stockpiled materials. All temporary storage means and methods shall be approved by the City of New York, Construction Manager and Commissioner.

1.10 WARRANTY

A. Warranty: The special warranty specified in this Section shall not deprive the City of New York may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit to Construction Manager a written warranty executed by the installer agreeing to repair or replace components of Gravel, Peastone, and edging that fail in materials or workmanship within the one year period. Failures include, but are not limited to, the following:

1. Premature wear and tear, provide the material is maintained in accordance with manufacturer's written maintenance instructions.

2. Failure of system to meet performance requirements.

C. Contractor shall provide, for a period of one year of service and repairs as required.

PART 2 PRODUCTS

2.1 PEASTONE PAVING (AT SECURITY CABLE MAINTENANCE ZONE)

A. Peastone Paving shall be rounded stone from granite or other hard durable stone.

1. Type: Delaware Blend

2. Size: 1" dia.

   a. Naturally rounded cross-bedded sandstone and quartzite made up of multi-colored grays, tans, and rusts

3. Source:

Geo Schofield
831 E. Main Street
Bridgewater, NJ 08807
1-800-827-6257
Tel: 732-356-0858
Fax: 732-356-1137

GreenPro Materials
Div. of Tri-State Materials LLC
P.O. Box 265
Bound Brook, NJ 08805
(P) 908-647-0159
(F) 908-647-0835

Or approved equal

2.2 ROUNDED GRAVEL IN WETLAND CELLS

A. Gravel shall be rounded stone from granite or other hard durable stone.

1. Type: Delaware Blend

Size: 3" – 5" dia.

   a. Naturally rounded cross-bedded sandstone and quartzite made up of multi-colored grays, tans, and rusts

   b. Source for :

Geo Schofield
831 E. Main Street
Bridgewater, NJ 08807
1-800-827-6257
Tel: 732-356-0858
Fax: 732-356-1137

GreenPro Materials
Div. of Tri-State Materials LLC
P.O. Box 265
Bound Brook, NJ 08805
(P) 908-647-0159
(F) 908-647-0835

Or approved equal

PART 3 EXECUTION

3.1 INSPECTION

A. Examine areas indicated to receive Gravel or Peastone with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verification of sub-grade: Verify that sub-grade has been properly compacted and graded to correct elevations.

C. Utilities and Structures: Verify that the locations of utility structures, appurtances and other surface features have been clearly marked or are visible.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove foreign substances, from substrates, that could impair installation and performance of Screenings, Peastone, and Riverstone.

B. Make any corrections necessary to sub grade or base furnished and installed to bring compacted gravel base to the elevations shown on the drawing.

C. Place filter fabric or edge restraints or headers if specified.

3.3 INSTALLATION GENERAL

A. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

B. Placement / Compaction

1. Place the aggegate on a prepared subgrade, and rake smooth to desired grade and cross section and required depth allowing extra material depth so that the post-compacted depth is as specified.

3.4 INSPECTION

A. Finish surface shall be uniform, to specified grade. Compacted surface shall be firm to full depth with no soft areas.

3.5 PROTECTION

A. Protect paving from damage due to related construction operations, by other contractors, trades and trespassers. Treat, repair or replace damaged work as directed by Construction Manager.

3.6 GUARANTEE SERVICE

A. Remove debris, such as paper, grass clippings, leaves or other organic material by mechanically blowing or hand raking the surface as needed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus aggregate or other waste material, including unsuitable soil, trash, and debris, and legally dispose of it off of the City of New York's property.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 321216

BITUMINOUS PAVEMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Asphaltic Concrete Pavement Roads and Walks.

1.3 RELATED SECTIONS

A.	Sustainability Requirements	- Section 013010
B.	Geosynthetic Soil Stabilization and Layer Separation	– Section 313219
C.	Earthwork	– Section 312000
D.	Concrete Paving	– Section 321313
E.	Planting Soil Mixes	– Section 329113

1.4 SUBMITTALS

A. Contractor shall furnish all working drawings and specifications in accordance with Division 01 DDC Standard General Conditions and Section 013010 Project Specific Sustainability Requirements. The following shall be submitted as a minimum.

1. Qualifications: Manufacturer and Installer

2. The bituminous mix design for both the binder course and the wearing course, which shall include the sources of all ingredient materials, the penetration of the asphaltic cement and the percentages by weight and the number of pounds of each of the materials making up one batch.

3. The laboratory analysis of the bituminous mix and the laboratory compacted density.

B. LEED Submittals Requirement

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section

018113 – Sustainable Design Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributed (e.g., recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submitttal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Manufacturer Qualification: Manufacturer shall be ISO 9002 certified. Provide proof of certification or demonstrate that the standards and experience required for certification are possessed, all to the satisfaction of the Engineer.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Bituminous pavement shall contain not less than 30% recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

B. Bituminous pavement materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 MATERIALS

A. Roads and Walks: Provide asphaltic concrete pavement for roadways conforming to the requirements specified in this section and to the following standards:

1. Bottom Course: Broken stone, NYCDOT, Bureau of Highway Operations Standard Specifications, Section 2.02, Aggregate-Coarse, Type 1, Grade B, Sizes No. 1, No. 2 and No. 4. Provide bottom course consisting of a uniform mixture of broken stone, Size Nos. 1 and 2, and add No. 4 as a filler after the coarser mixture has been rolled and compacted.

   a. As of January 1, 2015, asphaltic concrete shall contain not less than 30 percent reclaimed asphalt pavement by weight (LL71 of 2011).
   Alternate Material for Bottom Course: Recycled Aggregate shall meet NYCDOT, Bureau of Highway Operations Standard Specifications, Section 2.02, Aggregate-Coarse, Type 1, Grade B, Sizes No. 1, No. 2 and No. 4. Provide bottom course consisting of a uniform mixture of broken stone, Size Nos. 1 and 2, and add No. 4 as a filler after the coarser mixture has been rolled and compacted.

2. Tack Coat: Asphalt emulsion, NYSDOT Standard Specifications, material designation 702-90.

3. Binder Course: Binder mixture, NYSDOT Standard Specifications, Subsections 401-2.01 through 401.2.05, Table 401-1, Type 3.

4. Wearing Course: NYSDOT Standard Specifications, Subsections 401-2.01 through 401-2.05, Table 401-1, Type 6F.

PART 3 EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where miscellaneous specialties are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

C. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

3.2 ROADS

A. General: Asphaltic concrete pavement roads shall consist of

1. A bottom course of broken stone.

2. A tack coat of asphalt emulsion.

3. An intermediate course of asphaltic concrete (close binder type).

4. A tack coat of asphalt emulsion, and

5. A wearing course of fine surface mix asphaltic concrete (top mix).

B. Preparation of Subgrade:

1. Remove to a depth of 24 inches, top soil, boulders, muck, soft clay, spongy material and any other objectionable material and replace them with broken stone, sand and gravel or other approved fill to promote positive drainage.

2. On sites where it appears that there may be some areas containing objectionable materials, proof roll to locate the unsuitable materials.

3. Exercise care during stripping operations to prevent excessive disturbance to subgrade. Use lightweight dozers or grade-alls for low strength, saturated, noncohesive and low cohesive soils.

4. For extremely soft ground such as peat bog areas, do not over excavate surface materials to take advantage of root mat strength.

5. If vegetation is present, cut at ground surface and place sawdust or sand over stumps and roots extending above ground surface.

6. Scrape and fill subgrades, as necessary, and thoroughly consolidate them to the required lines and grades. Consolidate subgrades for pavements by means of a

smooth steel-wheel roller having a nominal gross weight of not less than 10 tons, and exerting a minimum force of not less than 300 pounds per inch of width on the compression roll faces, or approved equivalent.

7. Compact subgrade to not less than 75 percent relative density as determined by ASTM D2049, or not less than 95 percent of the maximum dry density as determined by ASTM D1557, as applicable.

8. In places where the use of a roller is impractical, compact subgrades with hand tampers weighing not less than 40 pounds and having a face not exceeding 80 square inches in area.

9. Subgrade shall be prepared not less than 100 feet in advance of the pavement to be immediately constructed.

10. End-dump base aggregate on previously placed aggregate.

    a. For subgrades with CBR less than or equal to 1, limit pile heights to prevent possible subgrade failure.

    b. Maximum placement thickness for subgrades with CBR less than or equal to 1 shall not exceed design thickness of road.

11. Spread and grade first lift of aggregate to 300 mm (12 in) or to design thickness if less than 300 mm (12 in) prior to compaction. Do not allow traffic on soft roadway with less than 200 mm (8 in) of aggregate over geotextile, except 150 mm (6 in) for CBR greater than or equal to 3.

12. Compact the bottom course as specified in Paragraph C.2. Vibratory compaction shall not be used on the initial lift over the geotextile.

13. Perform construction parallel to road alignment.

14. Fill ruts formed during construction to maintain adequate cover over geotextile. Do not blade ruts down.

15. Place remaining base aggregate in lifts not exceeding 250 mm (10 in) in loose thickness and compact to specified density.

16. Equipment may operate on roadway without aggregate for geotextile installation under permeable bases if subgrade is of sufficient strength.

    a. For soils with CBR less than or equal to 0.5, use lightweight construction vehicles for access on first lift.

    b. Limit construction vehicles in size and weight to limit rutting in initial lift to 75mm (3 in).

    c. If rut depths exceed 75 mm (3in), decrease construction vehicle size or weight or increase lift thickness.

17. Turning will not be permitted on first lift of base aggregate. Construct turn-outs at roadway edge to facilitate construction.

C. Bottom Course:

1. Spreading

a. Spread the mixture of No. 1 and No. 2 broken stone uniformly with shovels from piles along the side of the roadway or from dumping boards or by means of vehicles of approved design constructed especially for this purpose, but in no case dump the material directly on the geotextile.

b. The loose lift thickness shall be a minimum of 1.5 times the maximum particle size. The Contractor shall control the lift thickness, provided that the thickness shall not exceed the thickness limitations specified in Paragraph C, above, for installation of aggregate, and shall not exceed the maximum allowed according to the equipment classifications in Subparagraph B of Subsection 203-3.12, Compaction, of New York State Department of Transportation Standard Specifications, and the equipment meets all specified class criteria of that Standard.

c. Spread broken stone in sufficient quantity to provide the required thickness after rolling. The depth of stone shall be gauged by the use of cubical concrete blocks of the required thickness, or other approved means.

d. Remove all segregated fine or coarse stone and replace it with well graded stone.

e. Do not place broken stone over wet geotextile.

f. Do not place broken stone adjacent to manhole heads or other structures until such structures have been set to the required lines and grades.

2. Rolling and Filling

a. After the No. 1 and No. 2 stone mixture has been laid loose, thoroughly roll it with an approved smooth steel-wheel roller having a nominal gross weight of not less than 10 tons and exerting a minimum force of 300 pounds per inch of width on the compression roll faces.

b. Start rolling longitudinally at the sides and proceed toward the center, overlapping on successive trips by at least one half the width of a rear wheel. A minimum of 8 passes shall be applied over each lift with the roller operating at a speed not exceeding 6 feet per second. Rolling shall be continued until there is no movement of the stone ahead of the roller.

c. After the bottom course is thoroughly compacted, as measured by the method described in Paragraph f, below, uniformly spread No. 4 stone over the compacted area from piles along the side of the roadway or from dumping boards. Broom the filler in and roll it dry until no more filler can be forced into the voids. Remove excess filler.

d. Do not lay over 500 lineal feet of the bottom course without it being rolled and thoroughly filled.

e. The maximum layer thickness prior to compaction shall be 300 mm (12 in.) as specified in Paragraph 3.01C, and the final compacted thickness shall be as shown on the Contract Drawings. In confined areas as defined by the Engineer the maximum compacted layer thickness shall be 6 inches.

f. Do not allow the surface of the completed bottom course to deviate more than one-quarter inch in five feet from the nearest point of contact nor more than 3/8-inch in eighteen feet when tested by means of an eighteen foot straight-edge placed parallel to the centerline of the roadway.

g. If any irregularities develop in the surface during or after rolling of the bottom course, remedy them by loosening the surface and removing or adding broken stone as may be required, and follow by rolling the entire area, including the surrounding surface, applying filler and continuing rolling until the course is compacted satisfactorily to a uniform surface.

D. Tack Coat:

1. Before spreading the binder course, spray the bottom course with an asphalt emulsion tack coat in the amount of 0.25 gallon per square yard. Allow the tack coat to cure until sticky or tacky. Renew and repair or replace damaged coating.

2. Tack coat shall be applied evenly by means of a truck having appropriate spray nozzles. All nozzles shall be kept free of clogs.

3. Paint contact surfaces of all curbing, gutters, manholes and adjacent pavement edges with the tack coat material.

4. Tack coat shall not be applied on a wet pavement surface or when the temperature is below 45°F.

E. Binder Course:

1. Preparation: Clean the bottom course of all dirt and loose material, thoroughly dry it and obtain the Engineer's approval before laying the binder course.

2. Weather Limitations: Bituminous material or mixture shall not be applied on any soft surfaces, when the surface is wet, when the temperature of the surface on which the mixture is to be placed is below 45°F, or when other weather conditions would prevent proper construction of the pavement.

3. Forms: When side forms are required, accurately set them to line and grade and securely stake and brace them in place sufficiently to withstand all construction operations. Thoroughly clean and oil forms before use.

4. Spreading:

   a. Dump the binder course into the hopper of the spreader. Spread and screed it immediately to the full width required for the pavement and to such a depth that, when rolled, the required thickness is obtained. The maximum allowable compacted thickness shall be 4 inches.

   b. When the mixture is to be spread by hand, dump it on approved steel dump sheets outside of the area on which it is to be spread and immediately distribute it into place and spread it in a uniformly loose layer.

   c. Remove material from areas which show an excess or lack of bituminous material or an inconsistent mix and fill with new material. Respread or otherwise rectify areas which show segregation to obtain a uniform mixture in the course.

   d. Do not use mixture which has been over 45 minutes out of the mixer, or if longer, the mixture must be over 250°F when spread.

   e. Do not lay over 500 lineal feet of binder material without it being rolled and properly compacted.

5. Compacting:

   a. Rake the mixture after spreading and immediately compress it thoroughly and uniformly by either of the following methods:

      1). Option A – Three roller Compaction Train: Under this option, the binder course shall be initially rolled with an approved steel wheel roller. The roller shall overlap the previous roller pass by one-half the width of the roller.

         (a). Immediately following the initial rolling, the course shall be rolled with an approved pneumatic rubber-tired roller. A minimum of three passes of the rubber-tired roller shall be made. One pass is defined as one movement of the roller over any point of the pavement in either direction.

         (b). Immediately following the intermediate rolling, the course shall be finish rolled with a steel-wheel tandem roller. This final rolling shall be both longitudinal and diagonal as directed by the Engineer and shall remove all shallow ruts and ridges and other irregularities from the surface. Rolling shall be continued until all roller marks are eliminated.

(c). Under this option, the course shall not be compacted to a thickness in excess of 4 inches. No rollers shall move at speeds in excess of 3 miles per hour unless otherwise approved.

2). Option B – Vibratory Compaction: Under this option, the Contractor shall use vibratory compaction equipment appearing on the current Approved List - Bituminous Concrete Vibratory Compaction Equipment in the NYSDOT Standard Specifications. The Contractor may substitute one vibratory roller in lieu of the initial roller and the pneumatic roller in the conventional three-roller compaction train stipulated under Option A. Under this option, the course shall be finish rolled with a steel-wheel tandem roller having a minimum weight of 8 tons. This finish roller shall add a minimum of two passes closely following the vibratory roller or as directed by the Engineer.

(a). One vibratory roller and one steel-wheel tandem roller shall be provided for each nominal 12-foot width of paving. Dual vibrating drum rollers meeting the requirements of a steel-wheel tandem roller and operating in the static mode may be used as the finish roller. However, this single vibratory roller shall not be used as both the initial roller and the finish roller.

b. To prevent adhesion of the mixture to the roller, keep the drum properly moistened with water. Drums must have working water spray nozzles to keep drums moistened.

c. Compact material thoroughly with hot irons or damp vibratory tampers along curbs, headers, manholes and similar structures and at all places not accessible to the roller.

d. Remedy depressions which develop before the completion of the rolling by loosening the laid mixture and adding new mixture to bring such depressions to a true surface. Should any depressions remain after the final compaction has been obtained, remove the full depth of the mixture, replace it with new mixture, and reroll it to form a true and even surface. Correct all high spots, waves, bunches and honeycombing, to the satisfaction of the Engineer.

e. Remove and replace with new material areas that are unbonded after rolling, areas containing drippings, areas that are fat or lean, and areas evidencing defective construction of any description.

f. Do not allow the surface of the completed binder course to deviate more than 1/16 inch per foot from the nearest point of contact nor more than 1/4 inch

maximum when tested longitudinally with an 18-foot straight edge placed parallel to the centerline of the roadway.

g. After final compression, the finished course shall at no point have a density less than 95 percent, as measured by a nuclear density meter, of the laboratory compacted density.

F. Wearing Course:

1. Preparation:

a. Thoroughly clean the binder course of all loose and foreign material before the top mixture is delivered.

b. Apply a tack coat at a rate of 0.03 to 0.07 gallon per square yard as approved by the Engineer.

c. Do not lay mixture until the Engineer approves the binder course and determines in all cases whether the weather conditions are suitable to permit laying.

2. Weather Limitations: Bituminous material or mixture shall not be applied on any soft surfaces, when the surface is wet, when the temperature of the surface on which the mixture is to be placed is below 45°F, or when other weather conditions would prevent proper construction of the pavement.

3. Forms: If at the time of laying the mixture, permanent side supports such as curbs, edgings or gutters have not been constructed, firmly fasten in place suitable side forms of wood or steel, true to line and grade. In all cases adequately support the sides of roadways until final compaction has been obtained and the mixture has hardened by cooling.

4. Spreading and Compacting:

a. Spread and compact the wearing course until it meets the compaction and surface requirements specified above for the binder course.

b. The Contractor shall have the same options for achieving the required compaction as given for the compaction of the binder course.

c. Do not lay over 500 lineal feet of wearing course material without it being rolled and properly compacted.

d. Do not use mixture which has been over 45 minutes out of the mixer, or if longer, the mixture must be over 250°F when spread.

5. Joints: Perform construction as near continuously as possible. Carefully make joints between old and new pavements, or between successive days' work, in a manner which will insure a thorough and continuous bond, as follows:

   a. Cut back the edge of the old surface before recommencing the operation of laying, in order to present a fresh, clean surface for contact with the newly placed material.

   b. Carefully employ hot smoothing irons to heat the old pavement sufficiently (without burning) to insure a proper bond.

6. Shoulders: If temporary forms are used, protect the edges of the finished roadway by placing and thoroughly compacting approved material to form shoulders along the roadway as shown on the Contract Drawings. Construct finished shoulders 1/4 inch above the elevation of the finished roadway edges:

7. If weather conditions necessitate delaying the installation of the wearing course for more than two days, the tack coat shall be reapplied to the binder course at the rate of 0.03 to 0.07 gallon per square yard as approved by the Engineer.

3.3 WALKS

A. General: Asphaltic concrete pavement walks shall consist of:

   1. A bottom course of broken stone.

   2. A tack coat of asphalt emulsion.

   3. An intermediate course of asphaltic concrete (close binder type).

   4. A tack coat of asphalt emulsion, and

   5. A wearing course of fine surface mix asphaltic concrete (top mix).

B. Subgrade

   1. Refer to Paragraph 3.2.B for Subgrade Requirements.

   2. Before the bottom course is laid, compact the subgrade thoroughly, so that the bottom course, after compaction, will be found satisfactory when tested by the method given in Paragraph 4, below, and clean it of all loose and foreign material, dry it, and obtain the Engineer's approval.

C. Bottom Course:

   1. Refer to Paragraph 3.2.C for Bottom Course Requirements.

D. Tack Coat:

   1. Refer to Paragraph 3.2.D for Tack Course Requirements.

2. Paint contact surfaces of all curbing, gutters, manholes and adjacent pavement edges with an asphalt emulsion tack coat at the rate of 0.03 to 0.07 gallon per square yard as approved by the Engineer.

E. Binder Course:

1. Refer to Paragraph 3.2.E for Tack Course Requirements.

2. Set forms, spread and compact the bottom course as specified above for the binder course for roads.

3. Provide a bottom course surface free from depressions exceeding 3/8-inch when tested with a 10-foot straight edge placed parallel with the center line of the walk.

F. Wearing Course:

1. Refer to Paragraph 3.2.F for Wearing Course Requirements.

2. Clean the bottom course of all loose and foreign material before the wearing course mixture is delivered. Do not lay mixture until the Engineer approves the bottom course and determines in all cases whether the weather conditions are suitable to permit laying.

3. If at the time of laying the mixture, permanent side supports such as curbs, edging or gutters have not been constructed, fasten in place suitable side forms of wood or steel, true to line and grade. In all cases, adequately support the sides of walks until final compaction is obtained and until the mixture hardens.

4. Spread and compact the wearing course as specified for the bottom course.

5. Provide a walk surface free from depression exceeding 1/8-inch when measured with a 10-foot straight edge placed parallel with the centerline of the walk.

6. Perform construction as near continuously as possible. Carefully make joints between old and new pavements, or between successive days' work, in a manner which will insure a thorough and continuous bond, as follows:

   a. Cut back the edge of the old surface before recommencing the operation of laying, in order to present a fresh, clean surface for contact with the newly placed material.

   b. Carefully employ hot smoothing irons to heat the old pavement sufficiently (without burning) to insure a proper bond.

7. Paving procedure, including compaction requirements, shall be the same as specified above for the wearing course for roads.

3.4 PAVEMENT SAMPLES

A. When required by the Engineer, furnish 4-inch diameter test samples cored from the binder course and from the completed pavement. The Engineer will choose the number of cores and the locations at which the cores shall be taken. Sample cores, when required, shall be taken for every 10,000 square feet of pavement and patch. Density test shall show that the sample is within 90 percent of the laboratory specimen. Replace with new mixture and refinish the areas of pavement so removed without additional compensation.

3.5 PATCHING

A. As directed by Engineer, remove and replace defective areas. Cut such areas and replace with fresh asphaltic concrete and compact to required density.

3.6 CLEANING AND PROTECTION

A. After paving, clear surfaces of excess asphaltic concrete and all foreign matter.

B. Protect new pavement until fully hardened.

C. Cover openings of drainage structures until permanent covers are placed.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 321217

AGGREGATE OVERLAY OVER ASPHALT PAVING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Aggregate Overlay over Asphalt Paving

2. Traffic Striping over Aggregate Overlay

1.3 RELATED SECTIONS

A.	Sustainability Requirements	- Section 013010
B.	Geosynthetic Soil Stabilization and Layer Separation	– Section 313219
C.	Earthwork	– Section 312000
D.	Bituminous Pavement	– Section 321216
E.	Concrete Paving	– Section 321313
F.	Planting Soil Mixes	– Section 329113

1.4 SUBMITTALS

A. Contractor shall furnish all working drawings and specifications in accordance with the DDC Standard General Conditions and Specification Section 013010 Sustainability Requirements. The following shall be submitted:

1. Qualifications: Installer as specified in "Quality Assurance". Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

2. Material Properties:

a. Aggregate
1). Description
2). Material Properties

b. Epoxy Overlay –
   1). Manufacturer's Data
   2). Independent Test Lab Report: Test results certified and verified by a nationally recognized independent testing laboratory verifying properties of the cured system as per Table 1 herein shall be submitted to the engineer for approval prior to application. This certification shall be provided on each batch number to be used on the project.

c. Traffic Striping over Aggregate Overlay:
   1). Manufacturer's data

3. Samples

   a. Aggregate - 1 lb minimum bag of aggregate representative of the full range of color and texture.
   b. Epoxy Overlay System:
      1). (Quantity 3) 12" x 12" samples of the epoxy overlay with aggregate. Samples shall include a representative 4" x 12" wide traffic stripe as per the requirements herein.

4. Timetable
   At the start of construction, within 60 days after the notice to proceed, Contractor to formally submit anticipated timetable of the asphalt paving and the subsequent anticipated timetable for the Aggregate Overlay over Asphalt Paving installation.

B. LEED Submittals Requirement

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post –industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the

Forms, provide documentation to certify each of the material attributed (e.g., recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submitttal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 QUALITY ASSURANCE

A. Contractor shall follow timing requirements for the time required between asphalt paving and aggregate overlay, as per paragraph 3.1 Advance Preparation herein.

B. Installer Qualifications:

1. the contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.Single Source: Obtain each type of product or material from a single source in order to provide materials of consistent quality in appearance and physical properties.

C. The overlay shall be applied on all areas using metering, mixing and distribution machinery appropriate for epoxy overlay installation.

1. The application machine shall feature positive displacement volumetric metering pumps controlled by a hydraulic power unit. Components A and B shall be stored in reservoirs which are independently temperature controlled and capable of maintaining 100°F $\pm$ 10°F to insure optimal mixing. Ratio check verification at the pump outlets as well as cycle counting capabilities to monitor output will be standard features. In line mixing shall be motionless so as to not overly shear the material or entrap air in the mix. The machine shall also make maximum use of the working time of the material, to insure proper "wetting" of the system, by mixing immediately prior to dispensing onto the substrate.

2. Hand mixing of material is not permitted.

D. Mock-Ups

1. Contractor shall provide a 20'x20' mockup of Aggregate Overlay over Asphalt Paving for Landscape Architect's approval. Mockup to include the boundary concrete curb to show the edge condition and 4" x 18' minimum mockup of the traffic striping.

E. Guarantee:

Installer to provide 1 year guarantee period after installation. At the end of 1 year, Installer will return to correct any delamination or defect of the aggregate overlay and/or pavement striping as directed by the Commissioner without additional cost to the City of New York.

F. Performance Acceptance

1. Friction Acceptance Testing: Within 60 days after installation of the Aggregate Overlay, the Installer shall measure the friction characteristics in accordance with ASTM E274. The minimum acceptable friction number (FN40R) is 60. Remove and replace Aggregate Overlay areas not meeting this requirement unless approved to remain in place by the project engineer.

2. Acceptance of the materials will be based on the certified test report received during the approval process, a certification of compliance from the manufacturer, and results of any acceptance tests ordered or performed by the engineer during construction.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Aggregate Overlay over Asphalt Paving shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

B. Aggregate Overlay over Asphalt Paving materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with the Specification Section 013010 Project Specific Sustainability Requirements.

C. Aggregate Overlay shall have a minimum Solar Reflective Index (SRI) value of 29.

1.7 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Liquid Material: All material shall be transported and stored in their original containers inside a dry, temperature controlled facility and maintained at a minimum temperature of 60°F and not to exceed 120°F.

D. Job Site Storage: The materials shall be stored on the jobsite in a dry, weather protected facility away from moisture and within the temperature range of 60°F to 90°F whenever possible. Outdoor storage is only permitted with manufacturer and Commissioner's approval.

E. Store resin materials in their original containers in a dry area. Store and handle materials according to the manufacturers recommendations.

a. Packing Requirement: All materials must be packaged in strong, substantial containers. The containers shall be identified as Part A and Part B and shall be plainly marked with the name and address of the manufacturer, name of the product, mixing proportions and instructions, lot and batch numbers, date of manufacture, and quantity contained therein.

2. Aggregate: All aggregate shall be stored in a dry, moisture-free atmosphere. The aggregate shall be fully protected from any contaminants on the jobsite and shall be stored so as not to be exposed to rain or other moisture sources.

F. Handling of Liquid Materials on the Job: Protective gloves, clothing, and goggles, and any additional PPE shall be available to workers and inspectors directly exposed to the material if desired. Material Safety Data Sheets (MSDS) shall be provided to all workers and inspectors as obtained from the manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Paving:

1. As per the 321216 Bituminous Pavement specification for Vehicular Asphalt Paving

B. Epoxy:

1. The modified epoxy resin and hardener shall be composed of a two-part, 100% solids, thermosetting, moisture insensitive, flexible compound meeting the requirements set forth in Table 1. The two-part modified epoxy system shall be formulated to provide simple volumetric mixing ratio of two components such as one to one by volume.

2. Type:

Per the following table:

Product Trade Name	**Supplier**	**Telephone**
E-Bond 526 Lo-Mod	Transpo Industries	800.321.7870
Pro-poxy Type III DOT	Dayton Superior	800-745-3700
174 Polymer Road System	PolyCarb, Inc	800-441-5369
Or Approved Equal		

3. Material Requirements

Table 1--PHYSICAL PROPERTIES OF THE EPOXY SYSTEM	
Property	Value
Compressive Strength, min. psi (at 3 hrs)	1,000
Compressive Strength, min. psi (at 24 hrs)	5,000
Tensile Strength, min. psi (at 7 days)	2,000 - 5000
Tensile Elongation, percent	30 - 80%
Water Absorption, percent by wt. Max.	1.0%
Shore D Hardness, 77°F	60 - 70
Gel Time, minutes	15 - 45 (100 gms)
Viscosity (Poise)	7 - 25
Adhesion to Concrete	100% failure in concrete
Percent Solids	100%

4. Method of testing

Tests shall be conducted in accordance with the following methods:

a. Compressive Strength: ASTM C109, *Compressive Strength of Hydraulic Cement Mortars.* The two components of the resin are to be thoroughly mixed in their appropriate ratios. Two volumes of graded silica sand in accordance with ASTM C778 shall be added to one volume of mixed resin. The samples shall then be prepared according to the requirements of ASTM C109 and allowed to cure for 7 days at 23 ± 2°C.

b. Tensile Strength and Elongation: ASTM D638, *Tensile Properties of Plastics,* Specimen Type I or Type II. Samples shall be cured at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5% relative humidity. Speed of testing shall be at 0.5 in./min.

c. Water Absorption: ASTM D570, *Water Absorption of Plastics,* Sample specimens shall be prepared according to section 4.1 and allowed to cure at 23 ± 2°C (73.4 ± 3.6°F) and 50 ± 5% relative humidity. Tests are then to be carried out as per section 6.1.

d. Shore D Hardness: ASTM D2240, *Rubber Property - Durometer Hardness.* Specimen shall be prepared as per ASTM D570 section 4.1 and allowed to cure at 23 ± 2°C (73.4 ± 3.6°F).

e. Gel Time: The following procedure shall be used to determine gel time. Measure 4 oz. of Part A and 2 oz. of Part B each at 25°C (77°F), into an unwaxed paper cup and record the time and mix immediately. 100 gms of this mixture shall be poured into a 6 oz. unwaxed paper cup and placed on a wooden bench top. Starting twenty minutes from the time recorded above, the mixture shall be probed every two minutes with a small stick until a small ball forms in the center of the container. The total time, including mixing, required for the ball to form shall be regarded as the gel time. The

test shall be performed in a room or enclosed area maintained at 25 ± 2°C (77 ± 3.6°F) and 50 ± 5% relative humidity.

f. Abrasion Resistance: ASTM C501, *Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abrader.* Tests shall be done using a CS-17 wheel and a 1,000 gram load for 1,000 cycles.

g. Adhesion to Concrete: ACI-503-R; Pull Out Test.

C. Specialty Aggregate for Aggregate Overlay

1. Aggregate to be used shall be non-friable, non-polishing, clean and free from surface moisture. It shall be durable and sound and have a proven record of performance in applications of this type. The aggregate shall be 100 percent fractured, thoroughly washed and kiln dried to a maximum moisture content of 0.2 percent by weight, measured in accordance with ASTM C566. The fracture requirements shall be at least one mechanically fractured face and will apply to materials retained on U.S. No. 10 sieve.

   a. Size: 3/32" – 3/16"
   b. Type: Granite Aggregate – white color with black specks - Mt. Airy or approved equal.
   c. Supplier:
   Aggregate:-3/32" – 3/16" (#1) Mt. Airy granite aggregate or approved equal
   The North Carolina Granite Corp.
   151 Granite Quarry Trail Mount Airy, NC 27030, http://www.ncgranite.com/
   Contact: Richard Zinsmeister, Tel: 336 719 2624
   Or Approved Equal

2. Aggregate shall have a minimum Mohs scale hardness of 6.5.

3. The gradation of the aggregate shall conform to the requirements of Table 2 or jointly approved by the manufacturer and project engineer.

TABLE 2
AGGREGATE GRADATION

Sieve Size	Percent Passing
No. 3 – 1/2	100
No. 5	25-100
No. 10	< 3

D. Traffic Striping over Aggregate Overlay:

1. Material:

a. Methyl-Methacrylate Beaded Two-Component Traffic Marking Paint

1). Two component liquid pavement marking materials that consist of a pigmented MMA resin and a catalyst, capable of full cure in a wide range of temperatures without requiring external heat sources. The two components are mixed as they are applied. The application requires specialized equipment.

Potential products include:

(a). Color Safe resin, as supplied by Transpo Industries, 20 Jones Street, New Rochelle, NY, 914-636-1000 or approved equal

2). Reflective Beads

(a). Post applied glass beads shall be Type 3 beads coated for use with MMA materials

(b). Application rate: 12 lbs/100 sf

(c). The striping target retroreflectivity shall be 450 mcd/lux/sq m for white stripe

(d). The bead's Refractive Index: minimum 1.5 RI

2. Installation tolerance

a. All lines to be straight, with 1/4" tolerance along an 18' length.

3. Color:

a. Parking lane, parking symbol and stop bar striping: White

4. Thickness: 90 mils, or as required for satisfactory installation.

5. Slip resistant

6. Meet the following technical criteria:

a.	Bond Strength ACI 503	over 500 psi
b.	Abrasion Resistance ASTM C 501:	Wear Index 85 mg or less
c.	Pencil hardness ASTM D-2240	Greater than 8H
d.	Flexibility D522	No cracking, flaking, peeling
e.	Yellowness Index ASTM D 1925:	30 or less (on asphalt surface)
f.	Minimum Retro-reflectivity:	125 millicandelas.

7. Conform to Federal Specification TT-P-1952E

PART 3 EXECUTION

3.1 ADVANCE PREPARATION

A. Contractor may NOT apply the Aggregate Overlay on asphalt that is newer than 90 days old – contractor must ensure that asphalt is installed a minimum of 90 days before installation of the aggregate overlay. See Paragraph 3.3A below for surface preparation.

B. The temperature must be above 50 degrees and the weather clear in order to install the aggregate overlay. For the purposes of advance scheduling, the rough 'season' for

installation is roughly from March 15th – October 15th, although it is completely weather and temperature dependent.

3.2 INSPECTION

A. General: Conduct a pre-installation conference with the Commissioner prior to construction. Furnish the Engineer a copy of the recommended procedures and apply the overlay system according to the manufacturer's instructions.

B. Examine the areas and conditions where miscellaneous specialties are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

C. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

D. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

3.3 PREPARATION

A. For Older Asphalt Surfaces (>90 Days Old), the surface shall be broomed and air blown. If the surface is excessively dirty as determined by the Comissioner, the surface should be power-washed and completely dried prior to installation. (Asphalt must be installed a minimum of 90 days prior to overlay application).

B. The overlay application equipment is allowed to drive on the surface during application provided precautions have been taken to insure that the surface will not become contaminated, as approved by manufacturer's representative on site.

C. All surfaces to be treated shall be dry at the time of application. Immediately before the application of any liquids, all prepared surfaces shall be cleaned with compressed air to remove dust and debris.

1. The Commissioner may consider alternate surface preparation methods per the overlay system manufacturer's recommendations. The Commissioner will approve the final surface profile and bituminous pavement cleanliness prior to the Contractor placing the epoxy overlay.

D. Installer to protect all joints, castings, curb faces, and adjacent surfaces prior to aggregate overlay installation. All joints and edge lines shall be taped to ensure a crisp straight line, as recommended by manufacturer. Curbs must be taped ¼" above finished grade at botom of curb to provide a straight surface.

3.4 EXECUTION

A. Application of the Epoxy Overlay

1. Perform the handling and mixing of the epoxy resin and hardening agent in a safe manner to achieve the desired results according to the manufacturer's instructions. Do not apply the overlay system if one of more of the following occurs:

   a. If it has rained within 24 hours before application or if rain is forecast (greater than 40%) within eight hours of application
   b. Ambient air temperature is below 50° F
   c. Moisture content in the deck exceeds 4.5% measured in accordance with ASTM D4263 or other approved method
   d. Materials component temperatures below 50° F

2. Application of Liquid: After mixing of the components via the mechanical application equipment, the liquid shall be evenly distributed on the clean, dry surface at the rate recommended by the manufacturer.

3. The number of layers (a minimum of one) and the application rates of the liquid in the various layers shall be as recommended by the manufacturer in order to achieve an average thickness of 60 mls (0.060 inches) (cured) on the surface.

4. After the application of the liquid, the maximum time allowed before broadcasting of the aggregate is as follows:

Above 90°F	10 minutes
80°F to 90°F	15 minutes
70°F to 80°F	20 minutes
60°F to 70°F	25 minutes
50°F to 60°F	35 minutes

5. No vehicle shall be allowed on the overlay during the curing period.

6. Broadcasting into the material shall be by truck-mounted equipment capable of variable width dispensing of the aggregate onto the roadway in a uniform manner as directed or otherwise approved by the manufacturer of the epoxy overlay.

7. The aggregate shall be broadcast in such a manner as to completely cover the substrate so that no wet spots appear, before the polymer begins to gel. The aggregate must be dropped vertically in such a manner that the level of the liquid is not disturbed.

8. Removal of Excess Aggregate: After the overlay has hardened, remove all loose and excess aggregate with a power vacuum, or other manufacturer approved method, shall be made prior to striping and opening to traffic.

9. Provide at least eight hours of curing or the minimum cure as prescribed by the manufacturer prior to opening that section of public or construction traffic. Do not allow traffic on the treated area until recommended by the manufacturer and directed by the Engineer.

3.5 CLEANING AND PROTECTION

A. After paving, clear surfaces of excess asphaltic concrete and all foreign matter.

B. Protect new pavement until fully hardened.

C. Cover openings of drainage structures until permanent covers are placed.

3.6 PAVEMENT STRIPING

A. Do not apply when air or surface temperatures are below 50 degrees F.

B. Use appropriate equipment to ensure straight lines, including but not limited to: High pressure pumping system.

C. Clean with power and hand brooms. Remove all excess aggregate and clean all dirt and debris from surface.

D. Embed glass beads as per manufacturer's instructions. Beads must be dropped mechanically by appropriate equipment or carefully dropped by hand in a vertical direction. (Throwing the beads in a horizontal direction reduces or eliminates the required reflectivity.)

E. Mark edges straight and uniform. Comply with manufacturer's recommendations.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 321313

CONCRETE PAVING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 RELATED SPECIFICATIONS

A.	Sustainability Requirements	– Section 013010
B.	Earthwork	– Section 312000
C.	Cast in Place Pervious Concrete Paving	– Section 321314
D.	Cast in Place Concrete	– Section 033000
E.	Ornamental Metals	– Section 057000

1.3 REFERENCES

A. Standard specification-New York City, Department Of Transportation (NYCDOT), Bureau Of Highway Operations.

B. American Concrete Institute (ACI):

1. Sp66-(88) - ACI Detailing Manual.

C. American Society For Testing And Materials (ASTM)

1. A185 - Standard Specification For Steel Welded Wire, Fabric, Plain For Concrete Reinforcement.
2. C31 - Standard Methods Of Making And Curing Concrete Test Specimens In The Field.
3. C33 - Standard Specification For Concrete Aggregates.
4. C78 - Standard Test Method For Flexural Strength Of Concrete (Using Simple Beam With Third-Point Loading).
5. C94 - Standard Specification For Ready-Mixed Concrete.
6. C150 - Standard Specification For Portland Cement.
7. C173 - Standard Test Method For Air Content Of Freshly Mixed Concrete By The Volumetric Method.
8. C494 - Standard Specification For Chemical Admixtures For Concrete.

D. Concrete Reinforcing Steel Institute (Crsi)

1. MSP - Manual Of Standard Practice.

1.4 SUBMITTALS

A. Submittals shall include, but not be limited to:

1. Qualification Data for Installer, manufacturer and testing agency

2. Welding certificates

3. Material certificates: submit at least 15 days prior to installation of materials, material data and certificates signed by manufacturer and contractor, certifying that materials comply with, or exceed, specified requirements.

a. Cementitious materials.
b. Admixtures.
c. Steel reinforcement and accessories.
d. Fiber reinforcement.
e. Curing compounds.
f. Joint filler material & backer rod
g. Sealant

4. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

a. Aggregates.

5. Concrete mix reports: submit at least 15 days before placing concrete, reports for each concrete mix type that contains the information specified herein.

6. Laboratory reports: submit results of tests performed within one working day after tests are performed.

7. Concrete repairs: submit repair procedures, including materials and methods to the engineer for approval.

8. Shop Drawings: submit shop drawings showing concrete paving, including fabrication, placement, and support of concrete reinforcement, and location of proposed construction joints, control joints (sawed), isolation and expansion joints. Shop drawings will show all locations of proposed concrete paving and concrete plank paving with pervious joints in relation to other built and proposed work, including but not limited to: buildings, walls, curbs, utilities, signage, hydrants, bike racks, etc, as measured on site. Comply with CRSI Manual Of Standard Practice and ACI Sp66.

9. Submit actual samples of the sealant for color selection by the Commissioner.

10. Submit samples as follows for concrete paving and concrete plank pavement for approval by the Commissioner.

a. (quantity 3) 12 inch x 12 inch x minimum 2inch slab of approved design mix with light, medium, and heavy exposed aggregate finishes.
b. Use specified form material, concrete mix, aggregate and color admixture, as specified herein.
c. Finish with finish treatments specified herein.

B. LEED submittal requirements

1. For all installed products and materials of this section, complete the materials reporting form (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.
b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: the contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. The contractor shall conform to the requirements of Specification 033000 – Cast-In-Place Concrete.

I. Contractor to perform Field Tests as per paragraph 3.4 Field Test Specimens herein.

J. Mock up for concrete plank paving for approval by the Commissioner: An approved mockup may be incorporated into the work. An unapproved mockup will require additional mockups until acceptance by the Commissioner.

1. Minimum (quantity 3) 3' – 2-1/2" x 11 – 6" x 6" thick plank slabs on grade with specified finish. Place three plank sections in typical configuration shown in drawings.

2. This mock-up is to include the 6" wide cast in place pervious concrete joint, which is located between the planks. Refer to the cast in place pervious concrete specification section for concrete mix, color and finish.

3. This mockup is to include one 'small trench drain'. See Specification 057000 Ornamental Metals.

1.6 LEED PERFORMANCE REQUIREMENTS

A. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the structural engineer. Certification and submittal of recycled content shall be in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

B. Structural steel (i.e. reinforcement bar, wire mesh, ladders) used in this section shall contain a minimum of 75% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).

Certification and submittal of recycled content shall be in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

C. Concrete paving shall have a minimum Solar Reflective Index (SRI) value of 29.

PART 2 PRODUCTS

2.1 REINFORCING MATERIALS

A. Welded wire, fabric: ASTM A185, sheet type only. Ensure that sheets are free from loose flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

B. Dowels: furnish epoxy coated steel bars conforming to ASTM A615, Grade 60. Fabricate dowels or cut to length at the shop or mill prior to delivery to the site. Ensure that dowels are free of loose flaky rust and scale, clean and straight. Before delivery, paint a minimum of two thirds the length of each dowel with one coat of epoxy paint. Shear dowels to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel.

C. Support for reinforcement: conform to recommendations by CRSI: Manual Of Standard Practice.

2.2 CONCRETE MATERIALS

A. Portland cement: White Cement - Lehigh Portland/TypeI/II ASTM C150. Do not use air entraining cement.

B. Aggregates: ASTM C33 and the requirements specified herein.

1. Granite Aggregate for Exposed Aggregate Surfaces shall be 3/8" Blend #1 Coarse Aggregate Mount Airy from The North Carolina Granite Corporation. Contact: Richard Zinmeister, Tel: 336 719 2624 or William Swift, Tel: 336 719 2653

   Or approved equal.

C. Admixtures

1. Color Pigment:

   a. Pigment must be certified to be compatible with the cement, aggregates, and all other constituent materials.
   b. Pigment shall be manufactured from one production run, shall have integral dispersal agents, and shall be packaged in dissolvable bags for the treatment of one yard. Color shall be as selected and approved by the Commissioner.
      1). Pigment shall be white cement + color admixture:
      Color: 3611 - Oyster White, Solar Reflective Index: 68

         (a). L.M. Scofield Company
         (b). Davis Colors
         (c). Solomon Colors, Inc

Or Approved Equal

2. Curing Materials: Wet cotton mats

3. Retarders: Retarding admixtures meeting the requirements established in ASTM C494, Type B or D. Use retarders only with prior written approval of the Engineer.

4. Exposed Retarder for Concrete Surfaces: Retarder shall be "Rugasol-S" as manufactured by Sika Corporation: 'Surface Retarder-S' by Euclid Chemical Corp or approved equal. Type and amount of material, to treat the surface with the specified exposure, shall be as recommended by the manufacturer.

5. Protective Coating

   a. Exposed aggregate flatwork sealer shall be a penetrating compound and shall have a VOC content of less than 250 grams per liter and be approved by color additive manufacturer for use with colored concrete.
      1). Product: Sealer shall be Scofield Repello as manufactured by the L.M. Scofield Company, Douglasville, Georgia, or approved equal.
      2). Available from:
         (a). Raw, 2800 College Point Ave, College Point NY 718 461 2200
         (b). Extech, 41-39 Avenue K, Newark NJ, 973 274 3340
         (c). Legge/Colonial Concrete, 81 Clay St, Newark NJ, 201 280 2170

D. Joints

1. Sawed Control Joints, as per the drawings and this specification, see Execution herein.

2. Expansion and Isolation Joints –
   Pre-molded bituminous fiber joint filler system, with a bond breaker and sealant

   a. Expansion and Isolation Joint Filler Strips: ASTM D 1752, Closed cell flexible foam expansion joint filler, compatible with sealants, shall be installed as recommended by manufacturer.
   b. Bond Breaker: Joint bond breaker, polyethylene tape or expanded closed cell polyethylene foam backer rod, shall be installed as recommended by manufacturer.
   c. Sealant: Prepared expansion and Isolation joints shall be coated with a primer followed by installation of a bond breaker and a self-leveling two-component polyurethane-based elastoneric sealant. Color of sealant shall match color of adjacent paving, as approved by the Commissioner.

E. Water: fresh and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

2.3 COMPACTED AGGREGATE SUBBASE

A. Compacted aggregate subbase: Broken stone, NYCDOT, Bureau of Highway Operations Standard Specifications, Section 2.02, Aggregate-Coarse, Type 1, Grade B, Sizes No. 1, No. 2 and No. 4. Provide bottom course consisting of a uniform mixture of broken stone, Size Nos. 1 and 2, and add No. 4 as a filler after the coarser mixture has been rolled and compacted.

2.4 PROPORTIONING AND DESIGN OF MIXES

A. Mix design criteria:

1. Mix shall include a Medium Range Water Reducing admixture with a final slump of 5" +/- ½".

2. Air Entraining Admixture: shall be in all concrete exposed to weather conditions in the finished work.

3. Air Content: 6% +/- 1% at point of delivery for 3/8" nominal maximum aggregate size.

4. Coarse aggregate shall be 3/8" Blend #1 Mount Airy Granite graded for concrete.

5. Compressive Strength (28 days): 4000 PSI strength minimum

2.5 CONCRETE MIXING

A. Refer to Specification Section 033000, Cast in Place Concrete.

2.6 EQUIPMENT, APPROVAL AND MAINTENANCE

A. Furnish dependable equipment appropriate and adequate to meet approved plan and schedule of work. Assemble equipment sufficiently early before start of paving to permit thorough inspection, calibration of weighing and measuring devices, and adjustment of parts. Equipment shall be subject to the approval of the Engineer. Maintain equipment in good working condition at all times.

B. Furnish and maintain at the jobsite, in good condition, one 12-foot straightedge for each paving spread in testing hardened Portland cement concrete surfaces. Straightedges constructed of aluminum or magnesium alloy must have blades of box or box-girder cross section with flat bottom, adequately reinforced to ensure rigidity and accuracy. The straightedges must have handles for operation on the pavement.

PART 3 EXECUTION

3.1 GRADE CONTROL

A. Establish and maintain lines and grades shown, by means of line and grade stakes placed at the jobsite.

3.2 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and to verify need for additional compaction. Proceed with pavement work only after non-complying conditions have been corrected and subgrade is ready to receive pavement.

B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, curing compounds, and sealers.

3.3 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

G. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

H. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 FIELD TEST SPECIMENS

A. General: Prepare concrete samples in the field to determine slump, air content, and strength of concrete. Make test specimens to determine conformance with strength requirements and, when required, to determine the time at which pavements may be placed in service. Determine air content in conformance with ASTM C173. Mold test specimens and cure in conformance with ASTM C31. Furnish materials, labor, and facilities required for molding, curing, and protecting test specimens at the site and under the supervision of the Engineer. Curing facilities for test specimens include furnishing and operating water tanks equipped with temperature-control devices that automatically maintain the temperature of the water at 73 degrees F plus or minus 5

degrees F. Also, furnish and maintain at site, boxes or other facilities suitable for storing specimens while in mold at temperature of 73 degrees F plus or minus 10 degrees F. Perform tests of fresh concrete and of hardened concrete specimens.

B. Specimens for Strength Tests: Make a group of test specimens for every 400 square yards of pavement placed. As a minimum, however, make a set of test specimens each shift that concrete is placed. Mold each group of test specimens from the same batch of concrete. A group of specimen consist of four (4) beams to be tested as follows: One specimen at 7 days of age, two at 28 days, and one as a spare. Perform strength tests in accordance with ASTM C78, flexural tests from concrete beams.

3.5 JOINTS

A. General: Construct joints and tool edges true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated on the drawings.

B. Construction Joints: Set construction joints at side and end terminous of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at a planned joint. When concrete placement cannot be continued, install the transverse construction joint within the slab unit but not less than 10 feet from a planned transverse joint. Dowel transverse construction joints as shown. When the construction joint is located at planned transverse joints, plant ½ of each dowel and oil to permit movement at the joint. Edge joints and saw to obtain a groove at the top conforming to the details and dimensions indicated. When concrete placing is resumed, use planned joint spacing beginning with the first regularly scheduled transverse joint.

1. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip pavements, unless otherwise indicted.
2. Install dowels, keys or keys with tie bars in the longitudinal construction joints as specified herein.

C. Isolation and Expansion Joints:

1. Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, walks, other fixed objects, and where indicated.
2. Locate expansion joints at intervals of 20 feet unless otherwise indicated.
3. Extend filler joints full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
4. Furnish joint fillers in one-piece lengths for full width being placed where possible. Where more than one length is required, lace or clip joint-filler sections together.
5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

6. Install Bond Breaker, expanded closed cell polyethylene foam backer rod or polyethylene tape, as recommended by manufacturer.
7. Install approved Sealant as recommended by the manufacturer. Sealant shall be applied cleanly without deviating more than 1/8" from the joint or from the terminations. Any sealant on adjacent paving shall be removed carefully without damaging the adjacent surface.

D. Contraction Joints: Sawed transverse and longitudinal contraction joints shall be of the weakened-plane or dummy-groove type. Construct transverse contraction joint, as specified herein.

1. Construct sawed joints by sawing a groove in the hardened concrete with a $^1/_8$ inch thick blade to the full depth as indicated on the drawings and specified herein.

   a. After expiration of curing period, widen upper portion of groove by sawing to width and depth indicate on the drawings.
   b. Vary time of sawing depending on existing and anticipated weather conditions, so as to prevent uncontrolled cracking of pavement.
   c. Commence sawing of joints as soon as concrete has hardened sufficiently to permit cutting concrete without chipping, spalling, or tearing.
   d. Inspect sawed faces of joints for undercutting or washing of the concrete due to early sawing.
   e. Delay sawing if undercutting or washing is sufficiently deep to cause structural weakness or excessive roughness in the joint.
   f. Saw joints at required spacing consecutively in sequence of concrete placement. Use a chalk line or other suitable guide to mark alignment of joint.
   g. The saw cut shall not vary more than ½ inch from the true joint alignment.
   h. Before sawing a joint, examine concrete closely for cracks.
   i. Saw joint if a crack has occurred near the joint location.
   j. Discontinue sawing when a crack develops ahead of the saw cut.
   k. Workmen and inspectors must wear clean, rubber-soled footwear.
   l. Limit number of persons walking on the pavement to those actually performing the sawing operation. Immediately after joint is sawed, thoroughly flush saw cut and adjacent concrete surface with water until all waste from sawing is removed from the joint.
   m. Respray membrane-cured surface damaged during the sawing operations as soon as surface become dry.

E. Dowels and Tie Bars - Fixed Form Installation

1. Use bonded-in-place method.
2. Place tie bars and dowels across joints where indicated on the drawings.
3. Correctly align and securely hold in proper horizontal and vertical position during placing and finishing operations.
4. Install tie bar in front of paver along longitudinal contraction joints, by insertion into the unconsolidated concrete.
5. Do not install by removing and replacing dowels in preformed holes.

6. Hold dowel assemblies securely in proper location by means of suitable pins or anchors.
7. Furnish an approved template for checking the position of dowels.
8. Paint the portion of each dowel intended to move within the concrete or expansion cap with one coat of red-lead or blue-lead paint.
9. Wipe clean the painted portion and coat with a thin even film of lubricating oil before concrete is placed.

3.6 PLACING

A. General: Do not place steel or concrete until tests on underlying courses are completed and the courses approved by the Engineer.

B. Placing Welded Wire Fabric: Furnish and install the wire fabric shown on the drawings. Position wire fabric on suitable metal chairs prior to concrete placement. Lap one spacing of wire fabric pattern with transverse reinforcing members touching and wire together.

C. Placing Concrete

1. Deposit concrete as close as possible to its final position in pavement cross section.
2. Place concrete continuously and at a uniform rate without unscheduled stops except for equipment failure or other emergencies.
3. Do not drop concrete freely more than 3 feet.
4. Do not allow workmen with foreign material on their footwear or construction equipment that might deposit foreign material to walk or operate in or on the concrete during placement and finishing operations.
5. Do not use re-tempered concrete or concrete which is non-plastic and unworkable, or does not meet the specified mix properties, or which is contaminated by foreign materials.

D. Vibration

1. Consolidate concrete with mechanical vibrating equipment during spreading.
2. Supplement consolidation by hand-spading, rodding, or tamping to maintain concrete members free of honeycomb, rock pockets and voids.
3. Do not insert vibrators into lower layers of concrete that have begun to set.
4. Do not allow vibrators to touch forms, tie bars, dowels, or other embedded items.
5. Bring pavement surfaces to correct elevation and strike off.
6. Use bull float, darby or highway straightedge to level surface free of lumps or hollows.

E. Placing During Cold Weather

1. Discontinue concrete placement when air temperature reaches 40 degrees F and is falling.
2. Do not resume until air temperature reaches 35 degrees F and is rising.

3. Furnish and install covers for maintaining concrete at a temperature of at least 50 degrees F for not less than 72 hours after placing.

F. Placing During Warm Weather: During periods of warm weather when the maximum daily air temperature is likely to exceed 85° F.

1. Sprinkle forms and/or underlying material with water immediately before concrete is placed.
2. Place concrete at coolest temperature practicable, but in no case will the temperature of concrete when placed exceed 90° F.
3. Cool aggregates and/or mix with water as necessary.
4. Chipped ice in mixing water may be required to cool concrete, subject to approval of the Engineer.
5. Place concrete continuously and rapidly at a rate of not less than 100 feet of paving lane per hour.
6. Alternately, place concrete as individual slabs in checkerboard pattern.
7. Keep finished surface of newly laid pavement damp by applying a water fog or mist with approved spraying equipment.

3.7 FINISHING OPERATIONS

A. Machine or Hand Finish: The sequence of operations is as follows: finishing, floating, straight-edging, texturing, and edging of joints.

B. Finishing and Floating

1. As soon as placed and vibrated, strike-off concrete and screed to crown and cross section and to such elevation above grade that, when consolidated and finished, surface of pavement will be at the required elevation.
2. Tamp surface until required compaction and reduction of internal and surface voids are accomplished.
3. Immediately following final tamping of surface, float pavement longitudinally from bridges resting on side forms and spanning but not touching concrete.
4. If necessary, place and screed additional concrete, and then float until a satisfactory surface is produced.
5. Advance floating operation not more than half the length of float, and continue floating over new and previously floated surfaces.

C. Surface Correction and Testing

1. After finishing and floating, but while concrete is still plastic, eliminate minor irregularities and score marks in pavement surface by means of straightedges.
2. Operate straightedges from sides of pavement or from bridges.
3. Test surface for trueness with a 12-foot straightedge held in successive positions parallel and at right angles to centerline of pavement.
4. Cover whole area as necessary to detect variations.
5. Advance straightedge along pavement in successive stages of not more than one-half the length of the straightedge.

6. Fill depressions with freshly mixed concrete, strike off, consolidate, and refinish.
7. Strike-off projections above required elevations and refinish.
8. Continue straightedge testing and finishing, until entire surface of the concrete is free from observable departure and conforms to surface requirements specified herein.

D. Finish:

1. Cast concrete with approved mix as specified herein:
2. Apply retardant application. Type and amount of material to treat the surface shall be as recommended by the manufacturer to achieve the exposure. Aggregate exposure of the coarse aggregate shall be as approved by the Commissioner per the approved samples.
3. After the concrete has set, but is still pliable, wash the retarded material from the surface to expose the aggregate. Aggregate exposure to match the approved sample.

E. Edging: After texturing, carefully finish edge of pavement along forms and at joints, where indicated or directed by the Engineer, with an edging tool to form a smooth rounded surface of the required radius. Eliminate tool marks and smooth edges true to line.

3.8 CURING AND PROTECTION

A. General: Protect concrete against loss of moisture and rapid temperature changes for at least seven (7) days from the beginning of curing operation. Protect unhardened concrete from rain, flowing water and wind. Furnish and install covers as necessary to prevent cracking of the pavement due to temperature changes. If any selected method of curing does not afford the proper curing and protection against concrete cracking and pavement is damaged, remove and replace damaged payment and employ another method of curing as directed by the Engineer.

B. Curing Methods: Cure concrete for at least seven days by one or more of the following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Cover concrete surface with specified mat, saturated and continuously wet. Ensure that mat covers concrete surfaces and edges, with 6-inches lap over adjacent mat.
3. Apply water-fog spray continuously to concrete surface.

3.9 PLAN GRADE AND SURFACE-SMOOTHNESS REQUIREMENTS

A. Ensure that finished surfaces of pavements, when tested as specified herein, conform to grade line and elevations shown and surface-smoothness requirements specified herein.

B. Plan Grade: Ensure that finished surfaces of pavements do not vary more than ½ inch above or below plan grade line or elevation established and approved at jobsite. Finished surfaces of new abutting pavements will coincide at their juncture.

C. Surface Smoothness: Ensure that finished surfaces of pavements have no abrupt change of $^{1}/_{8}$ inch or more and do not deviate from the testing edge of an approved 12-foot straightedge more than ¼ inch.

3.10 SURFACE TEST, DEFICIENCIES AND CORRECTIONS

A. Test finished surface for conformance with plan grade and surface smoothness requirements.

B. Grade Conformance Tests: Check pavement for conformance with plan grade requirements. Test finished surface of each approved pavement area by running lines of levels at intervals of 25 feet or less longitudinally and transversely to determine elevation of completed pavement. Furnish level surveys to Engineer as surveys are completed. Within 30 days after receipt of level surveys the Engineer will inform this Contractor in writing of areas defective in plan-grade requirements.

C. Surface-Smoothness Determinations: After concrete has hardened sufficiently to permit walking thereon, but not later than 36 hours after placement, test surface of pavement with a straightedge 12-foot. Test across longitudinal construction joints within 48 hours after the end of the curing period of the concrete placed in the adjacent lane. Inform Engineer when straightedge testing is planned. Operate straightedge in such manner as to reveal surface irregularities exceeding tolerances specified herein. Test entire area of pavement in both longitudinal and transverse direction on parallel lines 10 feet or less apart. Hold straightedge in contact with surface and move ahead one-half the length of the straightedge for each successive measurement. Carry lines of straightedging continuously across joints.

3.11 PAVEMENT TOLERANCES

A. Comply with the following tolerances:

1. Elevation: 1/8 inch.
2. Horizontal Perpendicular Alignments: 1/8 inch
3. Thickness: Plus 3/8 inch, minus 1/8 inch.
4. Surface: Gap below 10 foot-long, unleveled straightedge not to exceed 1/8 inch.
5. Lateral Alignment and Space of Dowels: 1 inch.
6. Vertical Alignment of Dowels: 1/4 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 1 inch
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.
11. No honeycombs at finish surface concrete will be accepted.

3.12 REMOVAL AND REPLACEMENT OF DEFECTIVE PAVEMENT AREAS

A. Remove defective pavement areas and replace as specified herein with pavements of thickness and quality required by these specifications.

B. In no case will the removal and replacement of concrete result in a slab less than the full paving width or a joint less than 10 feet from a regularly scheduled transverse joint.

C. Remove defective pavement carefully so that adjacent pavement is not damaged and existing keys or dowels at the joint are left intact.

D. When a portion of an un-fractured slab is replaced, make a saw cut 2 inches deep transversely across the slab in the required location.

E. Remove concrete and provide an essentially vertical face in the remaining portion of the slab.

F. Prior to placement of fresh concrete, clean face of slab of debris and loose concrete, and then thoroughly coat with a thixotropic epoxy-resin grout manufactured specifically for bonding fresh Portland cement concrete to existing hardened concrete.

G. Apply epoxy resin coating approximately 1/16 inch thick, by scrubbing a thin coat of epoxy grout into the surface with a stiff-bristle brush followed by a second application.

H. Place strips of polyethylene sheeting on vertical joint faces of adjacent slabs at juncture with slab to be patched as a bond-breaking medium.

I. Place fresh dry packed Portland cement concrete while the epoxy resin is still tacky and in such a manner that grout coating will not be removed.

J. Construct longitudinal and transverse joints of the replaced slab or portion thereof as indicated on the drawings.

K. No payment will be made for the defective pavements removed and replaced nor for the cost of removing the defective pavements.

3.13 PAVEMENT PROTECTION

A. Protect pavement against damage prior to final acceptance by the Engineer. Repair any damage to pavement before final acceptance at no cost to the City. Do not permit construction traffic on concrete pavement. Protect against spillage of any deleterious materials.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 321314

CAST IN PLACE PERVIOUS CONCRETE PAVING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Subgrade preparation

2. Cast-In-Place Pervious Concrete paving with Integral Pigment.

3. Furnishing or installing curing materials, reinforcing bars or carbon fiber fabric, concrete joints, keyways, thickened edges of concrete at joints, joint material, joint sealant, or sawcutting joints, used in construction of Portland cement pervious pavement.

1.3 RELATED SECTIONS

A.	Sustainability Requirements	- Section 013010
B.	Geosynthetic Soil Stabilization and Layer Separation	– Section 313219
C.	Earthwork	– Section 312000
D.	Concrete Paving	– Section 321313
E.	Planting Soil Mixes	– Section 329113

1.4 REFERENCES

A. Annual Book of ASTM Standards, 1997; American Society for Testing and Materials, Philadelphia, PA.
B. Standards of the American Association of State Highway and Transportation Officials (AASHTO).
C. ACI 522.1-08 Specification for Pervious Concrete Pavement
D. American Society of Testing and Materials ASTM C 29 "Test for Unit Weight and Voids in Aggregate."
E. ASTM C 33 "Specification for Concrete Aggregates."
F. ASTM C 42 "Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

G. ASTM C 117 "Test Method for Material Finer than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing."
H. ASTM C 140 "Methods of Sampling and Testing Concrete Masonry Units."
I. ASTM C 150 "Specifications for Portland Cement" (Types I or II only).
J. ASTM C 172 "Practice for Sampling Fresh Concrete."
K. ASTM C 260 "Specification for Air-Entraining Admixtures for Concrete."
L. ASTM C 494 "Specification for Chemical Admixtures for Concrete."
M. ASTM C 595 "Specifications for Blended Hydraulic Cements" (Types IP or IS only).
N. ASTM C 618 "Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete."
O. ASTM C 989 "Specification for Ground Granulated Blast-Furnace Slag for use in Concrete and Mortars."
P. ASTM C 1077 "Practice for Laboratories Testing Concrete and concrete Aggregates for use in Construction and Criteria Laboratory Evaluation."
Q. ASTM C 1688 "Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete."
R. ASTM D 448 "Specification for Standard Sizes of coarse Aggregate for Highway Construction.
S. ASTM D 1557 "Tests for Moisture-Density Relations of Soils and Soil Aggregate Mixtures using 10 Pound Rammer and 18-inch Drop"
T. ASTM E 329 "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction."
U. ASTM C 1701 "Standard Test Method for Infiltration Rate of In Place Pervious Concrete
V. NYCDOT Standard Highway Specifications, November 1, 2010, New York City Department of Transportation, New York, NY

1.5 SUBMITTALS

A. Qualification Data for installer, manufacturer and testing agency.

B. Product Data

1. Product Data: For each type of manufactured material and product indicated.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

3. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adustments.

4. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

a. Cementitious materials and aggregates
b. Steel reinforcement and reinforcement accessories
c. Fiber reinforcement
d. Admixtures
e. Applied Finish Materials
f. Curing Compounds

C. Samples: Samples of pigmented pervious concrete paving.

a. Provide one sample (3' x 3' x 12" as required in ACI522.1-08 for visual inspection.)
b. Provide one sample (3' x 3' x 12" as required in ACI522.1-08 for core sampling requirements.)

D. LEED Submittal Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this Form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and materials-only cost.

b. The percentages (by weight) of post-consumer and /or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufacturered.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g. recycled content, VOC content).

3. For products and materials in LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed on the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 522.1-13.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this section.

D. Contractor Qualifications

1. The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

2. If the placing contractor and concrete producer have insufficient experience with Portland Cement pervious concrete pavement, the placing contractor shall retain an experienced consultant or NRMCA Certified Pervious Craftsman to monitor production, handling, and placement operations at the contractor's expense.

E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

F. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

I. Test Panels:

1. Regardless of qualification, Contractor is to place, joint and cure two test panels, each to be a minimum of 225 sq. ft. at the required project thickness to demonstrate to the Commisioner's satisfaction that in-place unit weights can be achieved and a satisfactory pavement can be installed at the site location.

2. Test panels must be placed outside of the specified Portland Cement pervious locations on the project or at another test site. Test panels are too large to be used as part of the actual work.

3. Test panels shall be tested for thickness in accordance with ASTM C 1688 Density and Void Content of Freshly Mixed Pervious Concrete and for core unit weight in accordance with ASTM C 1754.

4. Satisfactory performance of the test panels will be determined by:

a. Compacted thickness within a ¼" tolerance of specified thickness.
b. Void Structure: 17% minimum; 23% maximum.
c. Unit weight plus or minus 5 pcf of the design unit weight.
d. If measured void structure falls below 13% or if measured thickness is greater than ¼" less than the specified thickness of if measured weight falls less than 5 pcf below unit weight, the test panel shall be removed at the contractor's expense and disposed of in an approved landfill.

J. Mock-ups – Contractor to provide the pervious paving mockup for Commissioner's approval as per Specification 321313 Concrete Paving.

1.7 PERFORMANCE REQUIREMENTS

A. Abrasion Resistance:

1. ADA Requirements: Minimum value of 0.6 Coefficient of Friction for ADA accessible level surfaces (0-5%) and 0.8 Coefficient of Friction for ADA ramp conditions (5%+).

1.8 LEED PERFORMANCE REQUIREMENTS

A. Concrete mix used in this section shall contain a minimum of 20% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the structural engineer. Certification and submittal of recycled content shall be in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

B. Structural steel (i.e. reinforcement bar, wire mesh, ladders) used in this section shall contain a minimum of 75% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Specification Section 013010 Project Specific Sustainability Requirements.

1.9 PROJECT CONDITIONS

A. Protection of Existing Improvements

1. Protect adjacent work from splashing of paving materials. Remove all stains from exposed surfaces of paving, structures, and grounds. Remove all waste and spillage.

2. Do not damage or disturb existing improvements or vegetation. Provide suitable protection where required before starting work and maintain protection throughout the course of the work.

3. Restore damaged improvements, including existing paving on or adjacent to the site that has been damaged as a result of construction work, to their original condition or repair as directed to the satisfaction of the Owner, and authority having jurisdiction at no additional cost.

B. Safety and Traffic Control

1. Notify and cooperate with local authorities and other organizations having jurisdiction when construction work will interfere with existing roads and traffic.

2. Provide temporary barriers, signs, warning lights, flagmen, and other protections

3. As required to assure the safety of persons and vehicles around the construction area and to organize the smooth flow of traffic.

C. Weather Limitations

1. Do not place Portland cement pervious concrete pavement mixtures when the ambient temperature is 40 degrees Fahrenheit or lower, unless otherwise permitted in writing by the Engineer.

1.10 PRE PAVING CONFERENCE

A. A pre-paving conference with the engineer shall be held two (2) days prior to beginning placing the pervious concrete. The contractor shall have the pervious concrete consultant, ready mix supplier, the foreman and the entire concrete crew that will form and place the concrete in attendance at this meeting.A pre-paving conference with the engineer shall be held two (2) days prior to beginning placing the pervious concrete. The contractor shall have the pervious concrete consultant, ready mix supplier, the foreman and the entire concrete crew that will form and place the concrete in attendance at this meeting.

PART 2 - PRODUCTS

2.1 CONCRETE MIX DESIGN

A. Contractor shall furnish a proposed mix design with proportions of materials prior to commencement of work. The data shall include unit weights determined in accordance with ASTM C 1688.

2.2 PORTLAND CEMENT PERVIOUS CONCRETE

A. Cement:

Portland Cement Type I or II conforming to ASTM C 150 or Portland Cement Type IP or IS conforming to ASTM C 595. Slag or Flyash may be used as part of the total cementitious content.

B. Aggregate:

Use #9 (1/4") Washed, crushed coarse aggregate with a minimum void content per ASTM C29 of 40%. If other gradation of aggregate are to be used, submit data on proposed material to the City of New York for approval.

C. Admixtures:

1. The following admixtures may be used as needed:

   a. Type A/F Water Reducing – ASTM C 494.
   b. Air Entraining Agent – ASTM C 260.
      May be used to improve resistance to freeze/thaw cycles.
   c. A viscosity modifier.
      Used to reduce paste drain down caused by using a dirty aggregate
   d. Buckeye Cellulose fibers
      Dosed at the rate of 3lbs per cubic yard

2. The following admixtures shall be used:

   a. A hydration stabilizer that also meets the requirements of ASTM C 494 Type B Retarding or Type D Water Reducing/Retarding admixtures. This stabilizer suspends cement hydration by forming a protective barrier around the cementitious particles, which delays the particles initial set.

   b. Internal Curing Admixutre - reduces the amount of cementitious material needed as well as the need for a viscosity modifier.

1). Product: HydroMax Internal Curing Admixture
2). Rate: Dosed at the rate of 1.5 oz/cwt of total cementitious material.
3). Available from:
(a). Concrete Management Solutions, 5449 Montville Drive, Medina, OH 44256, 216-373-6927, www.concretemanagementsolutions.com
(b). Murray Decorative Concrete Supply, 8329 Monticello Road, Shawnee Mission, KS 66227, 913.422.4443, www.murraydecorative.com
(c). ProContractor Supply, P.O. Box 87, Oakwood, GA 30566, 800.604.0088, www.procontractorsupplyinc.com

D. Integral Color Admixture:

1. Color Pigment:

a. Pigment must be certified to be compatible with the cement, aggregates, and all other constituent materials.
b. Pigment shall be manufactured from one production run, shall have integral dispersal agents, and shall be packaged in dissolvable bags for the treatment of one yard. Color shall be as selected and approved by the Commissioner.
c. Color: C-14 French Gray or approved equal
d. Manufacturers
1). LM. Scofield Company
2). Davis Colors
3). Solomon Colors, Inc.

E. Water: Potable water shall be used.

F. Proportions:

1. Cement Content: For pavements subjected to vehicular traffic loading, the total cementitious material shall not be less than 480 lbs. per cu. yd. For other pavement areas not subject to vehicular traffic loading, the total cementitious material shall not be less than 450 lbs. per cu. yd.

2. Aggregate Content: the volume of aggregate per cu. yd. shall be equal to 27 cu. ft. when calculated as a function of the unit weight determined in accordance with ASTM C 1688.

a. An aggregate/cement ratio range of 4:1 to 4.5:1.
b. A unit weight range of 105 lbs/cu. ft. to 140 lbs/cu. ft. per ASTM C 1688.
c. Voids of 17% to 23%.

3. Admixtures: Shall be used in accordance with the manufacturer's instructions and recommendations.

4. Mix Water: Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. (Mix water yielding a cement paste with a dull-dry appearance has insufficient water for hydration).

a. Water cement ratios can range from 0.30 to 0.38.

b. Insufficient water results in inconsistency in the mix and poor bond strength. High water content results in the paste sealing the void system primarily at the bottom and poor surface bond.

2.3 COMPACTED AGGREGATE SUBBASE

A. Compacted Aggregate Subbase: Broken stone, NYCDOT, Bureau of Highway Operations Standard Specifications, Section 2.02, Aggregate-Coarse, Type 1, Grade B, Sizes No. 1, No. 2 and No. 4. Provide bottom course consisting of a uniform mixture of broken stone, Size Nos. 1 and 2, and add No. 4 as a filler after the coarser mixture has been rolled and compacted.

B. Filter fabric

C. Propex PERC Pervious Concrete Infiltration Fabric or approved equal.

2.4 IMPERVIOUS LINER

A. Permalon, PLY-X 150, or approved equal.

PART 3 – EXECUTION

The City of New York shall be notified at least 24 hours prior to all aggregate subbase installation and pervious paving work

3.1 INSTALLATION

A. Subgrade preparation

1. Existing subgrade under bed areas shall NOT be compacted or subject to excessive construction equipment traffic prior to stone bed placement.

2. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake or equivalent and light tractor.

3. Bring subgrade of stone recharge bed to line, grade, and elevations required.

4. Fill and lightly regrade any areas damaged by erosion, ponding, or traffic compaction before the placing of stone.

B. Aggregate Subbase Installation

1. Upon completion of subgrade work, the Commissioner shall be notified and shall inspect at his discretion before proceeding with recharge bed installation.

2. Filter fabric, pipe, and aggregate subbase shall be placed immediately after approval of subgrade preparation. Any accumulation of debris or sediment which has taken place after approval of subgrade shall be removed prior to installation of filter fabric at no extra cost to the City of New York.

3. Place filter fabric in accordance with manufacturer's standards and recommendations. Adjacent strips of filter fabric shall overlap a minimum of sixteen inches (16"). Secure fabric at least two feet (2') outside of bed and take steps necessary to prevent any runoff or sediment from entering the storage bed. Place impervious liner over geo-textile extending six feet (6') beyond toe of slope face at building face, secure as recommended by manufacturer.

4. Install coarse aggregate in 6 inch maximum lifts. Lightly compact each layer with equipment, keeping equipment movement over storage bed subgrades to a minimum. Install aggregate to grades required on the drawings.

5. Following placement of bed aggregate, the filter fabric shall be folded back along all bed edges to protect from sediment washout along bed edges. At least a two foot (2") strip shall be used to protect beds from adjacent bare soil. This edge strip shall remain in place until all bare soils contiguous to beds are stabilized and vegetated. In addition, hay bales shall be placed at the toe of slopes which may be adjacent to beds to further prevent sediment from washing into beds during site development. As the site is fully stabilized, excess filter fabric along the bed edges can be cut back to gravel edge.

3.2 PORTLAND CEMENT PERVIOUS PAVEMENT CONCRETE MIXING, HAULING AND PLACING:

A. Mix Time: Central mixed concrete shall be mixed for a minimum of one minute after introduction of all materials into mixer. Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.

1. If a central mixed batch plant is used, the mixer must be rinsed out prior to loading pervious materials if a normal concrete mix was previously batched.

B. Transportation: The Portland Cement aggregate mixture may be transported by ready mix trucks or dump trucks or mixed on site and should be used within one (1) hour of the introduction of mix water, unless otherwise approved by an engineer. This time can be increased to 180 minutes when utilizing the hydration stabilizer specified above at the proper dosage rate, unless otherwise approved by an engineer.

C. Each truck should not haul more than two (2) loads before being cycled to another type concrete, unless delivered by dump truck or if a stabilizing hydration agent is used in the pervious concrete mix design or if field experience proves that there is no significant concrete buildup in concrete mixer after delivery.

D. Prior to placing concrete, the subbase shall be soaked and in a wet condition (no ponding of water) at time of placement. Failure to provide a moist subbase will result in a reduction in strength of the pavement.

E. Discharge shall be a continuous operation and shall be completed as quickly as possible.

1. If consolidation occurs during concrete discharge, placement shall be halted and wet concrete removed (this may happen towards the end of some loads).

F. Concrete shall be deposited as close to its final position as practicable and such that fresh concrete enters the mass of previously placed concrete. The practice of discharging onto subgrade and pulling or shoveling to final placement is not allowed.

G. Placing and Finishing Equipment: Unless otherwise approved by the City of New York or Commissioner in writing, the Contractor shall provide mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force.

H. The pervious concrete pavement will be placed to the required cross section and shall not deviate more than +/- 3/8 inch in 10 feet from profile grade.

I. If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort shall be used immediately following the strike-off operation.

J. Strike off the pervious concrete 1/2" to 3/4" above the final grade prior to compaction, if needed, by using either slip-form, form riding vibrating screed, form riding aluminum roller screed or laser screed. Strike off may be done by hand for sidewalks. Care must be taken to avoid filling voids in the concrete.

K. If vibration, internal or surface applied, is used, it shall be shut off immediately when forward progress is halted for any reason.

L. The Contractor will be restricted to pavement placement widths of a maximum of fifteen (15') feet unless the Contractor can demonstrate competence to provide pavement placement widths greater than the maximum specified to the satisfaction of the City of New York.

3.3 CURING

A. Curing procedures shall begin immediately following all finishing operations if PerviouShield (or approved equal) liquid spray on curing compound/densifier is used.

B. Curing procedures shall be complete within 20 minutes after the final placement operations if polyethylene sheeting is used.

1. The pavement surface shall be covered with a minimum .31 mil thick polyethylene sheet (painters plastic) or other approved covering material prior to final cross rolling of the surface and then covered with a layer of four to six (4 – 6) mil thick polyethylene sheeting. Prior to covering, an evaporative reducer shall be sprayed above the surface when required due to ambient conditions (high temperature, high wind, and low humidity). The cover shall overlap all exposed edges and shall be secured (without using dirt or stone) to prevent dislocation due to winds or adjacent traffic conditions.

C. Cure Time: Portland Cement Type I, II, or IS – 7 days minimum.

D. No truck traffic shall be allowed for 10 days (no passenger car/light trucks for 7 days and no pedestrian traffic for 24 hours).

3.4 Jointing

A. Control (contraction) joints shall be installed as indicated by plans. They shall be installed at a depth of the 1/ 3 to 1/4 the thickness of the pavement.

B. These joints can be installed in the plastic concrete or saw cut.

1. If saw cut, the procedure should begin as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking (normally after curing), minimum of 24 hours after placement.

2. Possible complications from saw cutting include:

a. Removal of plastic to perform saw cutting will cause pervious concrete to hydrate too quickly (Not a concern if PerviouShield is used). If plastic is removed to accommodate saw cutting, re-hydrating of pervious concrete is required.
b. Walking on pervious concrete too early can damage concrete surface

C. Transverse constructions joints shall be installed whenever placing is suspended a sufficient length of time that concrete may begin to harden.

D. Isolation (expansion) joints should be used in structure widths exceeding thirty (30) feet or at seventy five (75) feet on sidewalks or when pavement is abutting slabs or other adjoining structures.

E. Expansion joint material shall be K-form screed rail or approved equal.

F. To reduce raveling, if transverse or isolation joints are used, or where pervious concrete meets impervious pavement, extra compaction may be necessary.

G. Additional installation specifications for the pervious concrete provided by the material source and engineer shall be followed strictly.

3.5 PORTLAND CEMENT PERVIOUS PAVEMENT CONCRETE TESTING, INSPECTION, AND ACCEPTANCE

A. The City of New York will retain an independent testing laboratory.

B. The testing laboratory shall conform to the applicable requirements of ASTM E 329 "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction" and ASTM C 1077 "Standard Practice for Testing Concrete and Concrete Aggregates for use in Construction, and Criteria for Laboratory Evaluation" and shall be inspected and accredited by the Construction Materials Engineering Council, Inc. or by an equivalent recognized national authority.

C. The Agent of the testing laboratory performing field sampling and testing of concrete shall be certified by the American Concrete Institute as a Concrete Field Testing Technician Grade I, or by a recognized state or national authority for an equivalent level of competence.

D. Testing and Acceptance:

1. A minimum of 1 gradation test of the subgrade is required every 5000 square feet to determine percent passing the No. 200 sieve per ASTM C 117.

2. A minimum of one test for each load of pervious concrete in accordance with ASTM C 1688 to verify unit weight shall be conducted. Delivered unit weights are to be determined in accordance with ASTM C 1688 using a 0.25 cubic foot cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 1688. The unit weight of the delivered concrete shall be +/- 2.5 pcf of the accepted design unit weight.

3. It is highly recommended that unit weight testing per ASTM C 1688 be performed on every load of concrete to assure uniformity through the project.

4. Test panels shall have two cores taken from each panel in accordance to ASTM C 42 at a minimum of seven (7) days after placement of the pervious concrete. The cores shall be measured for thickness, void content and unit weight in accordance with ASTM C1754. Range of satisfactory unit weight values are +/- 5 pcf of the design unit weight.

5. After a minimum of seven (7) days following each placement, three cores shall be taken in accordance with ASTM C 42. The cores shall be measured for thickness, void content and unit weight determined as described above for test panels. Core holes shall be filled with concrete meeting the pervious design or other concrete material as permitted by the City of New York.

E. Service: There shall be a service plan submitted to the City of New York to prevent the clogging of the pervious concrete pavement which shall include periodic testing for flowability by the pervious concrete installer prior to the pervious concrete being opened to service, with flow rates reported in writing to the City of New York and again at six (6), twelve (12) eighteen (18) and twenty-four (24) months and again report the results in writing to the City of New York. It is the Contractor's responsibility to help the City of New York to develop a service plan. The City of New York must have a plan and methods to restore flowability if the flow rate drops below 75% of the original rate. Acceptable methods to restore levels of flowability are either to vacuum or powerwash the pervious concrete sections.

END OF SECTION

SECTION 321400

UNIT PAVERS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The contractor shall furnish, install, complete, test, make ready for operation and maintain concrete unit paver pavement as shown on the Contract Drawings and as specified herein. This section covers:

1. Linear Roof Pavers
2. Detectable Warning Pavers
3. Edge Restraints
   a. Edging at the Clubhouse Roof
      1). Edging at Linear Roof Pavers at Clubhouse Roof
      2). Gravel Edging at Clubhouse Roof
   b. Steel Landscape Edging

1.3 RELATED SPECIFICATIONS

A. Sustainability Requirements - Section 013010

B. Geosynthetic Soil Stabilization and Layer Separation - Section 313219

C. Earthwork - Section 312000

1.4 REFERENCES

A. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendation or suggestion shall be deemed to be mandatory under this Contract.

B. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations for the following:

C. American Society of Testing and Materials (ASTM) (latest edition):

1. C 33 Specification for Concrete Aggregates.
2. C 136 Method for Sieve Analysis for Fine and Coarse Aggregate.
3. C 140 Sampling and Testing Concrete Masonry Units.
4. C 144 Standard Specifications for Aggregate for Masonry Mortar.
5. C 936 Specifications for Solid Interlocking Concrete Paving Units.
6. C 979 Specification for Pigments for Integrally Colored Concrete.

7. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
8. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
9. D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports.

1.5 PERFORMANCE REQUIREMENTS

A. Provide materials that meet ASTM C241 Stone Abrasion Resistance for outdoor usage.

1.6 SUBMITTALS

A. Product Data:

1. Product Data: For each type of product indicated.
2. Color charts: For each type of sealant

B. Shop Drawings:

1. Provide shop drawings showing the proposed layouts of pavers, adjacent edgings and their relationships to nearby fixtures and utilites for Commissioner approval.

C. Samples:

1. Full-size units of each type of unit paver indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
2. Sealants: provide actual caulk and mortar samples showing color.
3. Full size edging samples for each type specified.

D. Testing:

1. Sieve analyses for grading of bedding and joint sand
2. Test results shall be submitted from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified

F. LEED submittal requirements

1. For all installed products and materials of this section, complete the materials reporting form (blank copy attached at end of Section 018113 – Sustainable Design Requirements). Information to be supplied for this form shall include:
   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).
c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.
d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

3. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

4. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.7 LEED PERFORMANCE REQUIREMENTS

A. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the structural engineer. Certification and submittal of recycled content shall be in accordance with the DDC General Conditions.

B. Structural steel (i.e. reinforcement bar, wire mesh, ladders) used in this section shall contain a minimum of 75% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with the DDC General Conditions.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed unit paver installations similar in material, design, and extent to that indicated for this project in the last 3 years and and whose work has resulted in successful construction installations.

B. Source Limitations: Obtain each type of unit paver, joint material, and setting material from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on the Project site during times unit paving installation is in progress.

D. Mockups: Before installing unit pavers, build mockups for each form and pattern of unit pavers required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed

Work, including same base construction, special features for expansion joints, edging and contiguous work as indicated:

1. A 7 ft. x 7 ft. paver area shall be installed for approval by Commissioner.
2. This area will be used to determine the amount that the pavers settle into bedding sand after compaction, joint sizes, lines, laying pattern(s), color(s), and texture of the project.
3. This area shall be the standard from which the work will be judged.
4. Notify Construction Manager and Commissioner seven days in advance of dates and times when mockups will be constructed.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Construction Manager and Commissioner's approval of mockups before starting unit paver installation.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect unit pavers and aggregates during storage and construction against soiling or contamination from earth and other materials. Maintain manufacturer's containers in unopened and undamaged condition with labels intact and legible.

1. Cover pavers with plastic or use other packaging materials that will prevent rust marks from steel strapping.

B. Bedding and joint sand shall be covered with a secure waterproofing covering to prevent exposure to rainfall or removal by wind.

C. Delivery and paving schedules shall be coordinated in order to minimize interference with noraml use of building adjacent to paving.

1.10 PROJECT CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing

B. Do not install sand or pavers during heavy rain or snowfall.

C. Do not install frozen sand.

1.11 WARRANTY

A. Warranty: The special warranty specified in this Section shall not deprive the Owner of other rights the Owner or may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit to Construction Manager a written warranty executed by the installer agreeing to repair or replace components of stabilized surfacing that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Premature wear and tear, provide the material is maintained in accordance with manufacturer's written maintenance instructions.
2. Failure of system to meet performance requirements.

C. Warranty Period: Contractor shall provide warranty for performance of product. Contractor shall warranty installation of product for the time of one year from completion.

D. Contractor shall provide, for a period of sixty days, service and repairs as required

PART 2 PRODUCTS

2.1 CONCRETE UNIT PAVERS

A. Varieties and Sources: Subject to compliance with requirements, provide the unit pavers specified for each type in 2.2 "Concrete Unit Paver Types":

B. Match Commissioner's samples for variety, color and finish, and other unit paver characteristics retaining to aesthetic effects.

C. Provide unit pavers that are free of cracks, seams and starts impairing structural integrity or function.

D. All unit pavers to be gauged for thickness.

2.2 CONCRETE UNIT PAVER TYPES

A. Linear Roof Pavers

1.	Product name:	Promenade Pavers
2.	Product shape:	4" x 16" x 3.94" (10cm)
3.	Product color:	Sandstone
4.	Finish:	Premiere face mix finish (top 1/4" to 3/8" shall be a smooth sand/cement mix integrally cast as part of the manufacturing process.)
5.	Edge:	Pavers shall have a "micro bevel" edge.
6.	Manufacturer:	Unilock NY, 51 International Blvd, Brewster, NY 10509, Rep: Sean O'Leary, 845-406-8294 Territory Manager Chris Wilkens 516-369-6877, Or approved equal.

7. Available via spec book from:
   a. Bayside Building Supply, 200-09 47th Ave, Bayside, NY 11361 (718) 428-4000
   b. Sammarco Stone and Supply, 173 Oak St, New Rochelle, NY 10801, (914) 636-6563
   c. County Line Mason Supplies, 167 Depot Road, Huntington Station, New York 11746, (631) 271-6679

8. Performance criteria:

a. Pavers shall be produced in strict accordance with ASTM C-936 standards. Manufacturer shall have a minimum of 3-years experience producing the specified shape style and finish outlined herein.
b. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units.
c. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
d. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.
e. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C 67, with no breakage greater than 1.0% loss in dry weight of any individual unit. This test method shall be conducted not more than 12 months prior to delivery of units.
f. Pigment in concrete pavers shall conform to ASTM C 979. ACI Report No. 212.3R provides guidance on the use of pigments.

B. Detectable Warning Paver

1. Nominal 2' x 3' x 3" thick
2. Color: Charcoal Gray
3. Finish: Natural / unblasted
4. Available from:

a. Hanover

Product:	Prest Paver Detectable Warning Paver
Actual Size:	23 ½" x 35 3/8" x 3" thick
Color:	Charcoal
Finish	Natural
Manufacturer:	Hanover Architectural Products, 240 Bender Road, Hanover PA 17331
Contact:	Lee Furhman, 717-637-0500

b. Wausau

Product:	ADA 2 Detectable Warning Paver
Actual Size:	23-13/16" x 35 13/16" x 2-3/4" thick
Color:	A-90
Finish	Unblasted (Natural)
Manufacturer:	Wausau Tile, 9001 Bus. Hwy 51, Rothschild, WI 54474
Contact:	Michael Conboy 631-650-0991

Or approved equal

2.3 EDGING AT THE CLUBHOUSE ROOF

A. Edging at Linear Roof Pavers at Clubhouse Roof:

1. Product: Permaloc GeoEdge
2. Size: 4.5" width x 4.5" height (or as shown in the drawings).

The height of the edging to be 1" less than finished grade at the pavers; the edging shall not be visible. The length of each edging section shall be 8' long, to be connected with (2) 2.75" sliding aluminum connectors.

3. Material: Extruded Aluminum – 6063 alloy containing Silicon and Magnesium
4. Finish: Mill finish (natural aluminum)
5. Hardware: Geoedge Capture Plate: Alumimum 3"x10"
6. Manufacturer: Permaloc Corporation, 13505 Barry Street, Holland, MI 49424, 1.800.356.9660
7. Available from:
   a. Terre Company, 206 Delawanna Ave, Clifton, NJ 07014 973-473-3393
   b. John Deere Landscape, 4-29 Banta Place, Fairlawn, NJ, 201-797-6350
   c. Fusco Brothers Supply, 55 River Road, Chatham, NJ, 973-635-6282
   Or approved equal

B. Gravel Edging at Clubhouse Roof

Product: Permaloc Geo Edge: linear along the parapets and prefabricated at the drains / utilities.

Size: 6.5" width x 5.5" height (or as shown on the drawings.) The height of the edging shall be flush with finished grade.

1. Material: Extruded Aluminum - 6063 alloy containing Silicon and Magnesium
2. Finish: Mill finish (natural aluminum)
3. Manufacturer: Permaloc Corporation, 13505 Barry Street, Holland, MI 49424, 1.800.356.9660
4. Available from:
   a. Terre Company, 206 Delawanna Ave, Clifton, NJ 07014 973-473-3393
   b. John Deere Landscape, 4-29 Banta Place, Fairlawn, NJ, 201-797-6350
   c. Fusco Brothers Supply, 55 River Road, Chatham, NJ, 973-635-6282
   Or approved equal

C. Geogrid

1. Syntec SBX11, as manufactured by Syntec, 4800 Pulaski Highway, Baltimore, MD 21224, 1-800-USGRIDS
2. Tensar Triax TX140, as manufactured by Tensar, 2500 Northwinds Parkway, Suite 500, Alpharetta, GA 30009, 770-344-2090
3. Stratagrid 200, as manufactured by Strata, 380 Dahlonega Rd Suite 200, Cumming, GA 30040, 770-888-6688

Or approved equal

2.4 STEEL LANDSCAPE EDGING

A. Steel Landscape Edging (on grade):

Comply with ASTM A 569, hot-rolled, standard flexible carbon steel landscape edging, fabricated in sections with stake pockets stamped, punched, or welded to face of

sections approximately 30" apart to receive stakes. Steel landscape edging shall be double staked at overlap joints, and designed to receive tapered steel stakes.

1. Size: 1/4"c thick, 4 5"c wide, by 16' length, with 6 stakes (actual coverage 15'-4")
2. Finish: Hot-Dipped Galvanized finish to be applied after steel landscape edging is cut to length and stake pockets are stamped, punched or welded. Galvanization shall comply with ASTM A123/A123M-97A. Zinc coverage shall be to a standard thickness of 3/16" x 4" wide, by 16' length – 3.0 mil (1.7 oz/ ft2).
3. Product: "DURAEDGE",
   As supplied by The J D Russell Company,
   Tucson, AZ,
   800-888-7425

   Or Approved Equal

B. Steel Landscape Edging Stakes:

Steel, tapered and finished to match specified steel landscape edging. Stakes designed specifically to anchor steel landscape edging in place, and shall be made by the manufacturer of the steel landscape edging for which they will be used.

1. Size: 3/16" thick x 16" minimum length
2. Finish: To match Steel Landscape Edging

C. Steel Landscape Edging Accessories

1. Standard start/end sections, 90° corners, splicers as required, sectional and one-piece circles.

2.5 BEDDING AND JOINT SAND

A. The bedding and joint sand shall be clean, non-plastic, and free from deleterious or foreign matter. It can be natural or manufactured from crushed rock. Do not use limestone screenings or stone dust that do not conform to the grading requirements in Table 3. When concrete pavers are subject to vehicular traffic, the sands shall be as hard as practically available.

B. The bedding sand shall conform to the grading requirements of ASTM C 33 as shown in Table 3.

TABLE 3
BEDDING SAND
GRADING REQUIREMENTS

Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100

No. 16 (1.18 mm)	50 to 85
No. 30 (600 µm)	25 to 60
No. 50 (300 µm)	10 to 30
No. 100 (150 µm)	2 to 10

C. The joint sand shall conform to the grading requirements of ASTM C 144 as shown in Table 4 below:

TABLE 4
JOINT SAND
GRADING REQUIREMENTS

	Natural Sand	Manufactured Sand
Sieve Size	**Percent Passing**	**Percent Passing**
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 - 100	95 to 100
No. 16 (1.18 mm)	70 - 100	70 to 100
No. 30 (600 µm)	40 - 75	40 to 75
No. 50 (300 µm)	10 - 35	20 to 40
No. 100 (150 µm)	2 - 15	10 to 25
No. 200 (75 µm)	0	0 to 10

2.6 CONCRETE SUBSLAB FOR UNIT PAVERS

A. 3200 PSI concrete reinforced with WWF 6x6 10/10, with expansion joints as indicted or 20 feet on center or every 400 SF.

B. Aggregate Base for Concrete Subslab: Sound crushed stone or gravel complying with DOT standards.

2.7 MORTAR SETTING BED MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II.

B. Hydrated Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144.

D. Latex Additive: acrylic resin, water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.

E. Water: Potable.

F. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch in diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M except for minimum wire size.

G. Color additive: Mortar color is to be as approved by the Commissioner.

2.8 SEALANT

A. Product: See specification 079200 Joint Sealers

B. Color: To match adjacent paving, as approved by the Commissioner prior to installation.

PART 3 EXECUTION

3.1 GRADE CONTROL

A. Establish and maintain lines and grades shown, by means of line and grade stakes placed at the jobsite.

3.2 EXAMINATION

A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that subgrade preparation, compacted density and elevations conform to the specifications and drawings.

C. Utilities and Structures: Verify that the locations of utility structures, appurtances and other surface features have been clearly marked or are visible

D. Verify that geotextiles, if applicable, have been placed according to specifications and drawings.

E. Verify that aggregate base materials, thickness, compaction, surface tolerances and elevations conform to the specifications & drawings.

F. Local aggregate base materials typical to those used for flexible pavements are recommended, or those conforming to ASTM D 2940. Compaction to not less than 95% Proctor Density in accordance with ASTM D 698 is recommended for pedestrian areas. Compaction to not less than 98% Modified Proctor Density according to ASTM D 1557 is recommended for vehicular areas.

G. Verify the proper installation of the concrete curbing, in terms of location, elevation, and adherence to the specifications.

H. Verify that the base is dry, uniform, even and ready to support sand, pavers and imposed loads.

3.3 PREPARATION

A. Sweep or vacuum clean concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from concrete substrates that could impair asphalt bond, including curing and sealing compounds, form oil and laitance

3.4 EDGING INSTALLATION

A. Typical Edging Installation

1. Install straight sections true to the alignments as indicated, free of waves or bends, using strings as guides. Install curved sections true to the alignments as indicated, free of waves or bends, following marked alignments approved in the field by the Commissioner. Notify the Commissioner (1) one week in advance to approve the layout.

2. Install vertical alignment plumb. Edging shall be flush to grade unless otherwise indicated with no trip hazard (less than 1/8" difference between the edging and the adjacent grade).

3. Maximum tolerance is 1/16" maximum offset from vertical alignment, and 1/8" maximum offset from horizontal within a 10' run. Maximum tolerances shall not be cumulative.

B. Steel Landscape Edging:

1. Install Steel Landscape Edging where indicated on contract drawings, according to manufacturer's recommendations. Anchor with steel stakes approximately 30" on center, driven below top elevation of edging, or at every stake pocket location in landscape edging (header) sections designed and manufactured to receive stakes. Stakes shall be located in solid undisturbed soil, or in soil set at 85% relative compaction Field weld all butt joints and at joints that change in orientation.

2. Replace edging sections damaged by construction operations.

C. Edging at Linear Roof Pavers at Clubhouse Roof:

The 'Edging at Linear Roof Pavers' is intended to hold the paver, but be held an inch below the paver finished grade.

1. Verify conditions are appropriate for edging installation.

2. Place geogrid as described on the drawings. Place first side of edging, ensuring straight clean lines. Radial curves to be bent in the shop or to be sourced as bent from the manufacturer. Edges to be clean bends as per the manufacturer's instructions – under no condition shall an edging end at a corner.

3. Attach geogrid to edging with capture plate as per the manufacturer's instructions.

4. Set pavers, as per paver installation herein. If pavers do not set in a clean line as per the drawings, the edging shall be reinstalled to allow the pavers to be properly laid. The Commissioner will make the final determination as to whether the pavers have been properly installed.

D. Gravel Edging at Clubhouse Roof

The 'Gravel Edging at Clubhouse Roof" is intended as a clean separation between the gravel and the adjacent planting. The top of the edging shall be flush to grade.

1. Shop fabricate all corners.
2. Verify conditions are appropriate for edging installation.
3. Use the longest lengths possible. Connect sections together using the 2-3/4" sliding connector as per manufacturer's directions.

3.5 PAVER INSTALLATON GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be visible or cause staining on finished work.

B. In areas with a single paver type; mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Field cutting is to be minimized, only as approved by Commissioner. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, un-chipped edges. Cut units to provide pattern indicated to fit adjoining work neatly. Use full units with cutting where possible. Hammer cutting is not acceptable. Cut pavers to provide pattern indicated to fit adjoining work neatly or to fit cleanly around manholes, utility covers, appurtenances and other utility features. Sharp edges or corners created by cutting or splitting shall be worked smooth to produce a consistent quality with un-cut or un-split edges.

D. Tolerances:

1. Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8-inch in 10-feet from level, or indicated slope, for finished surface of paving.
2. Paver joints shall not exceed 1/16-inch spacing.
3. Pavers shall align horizontally with adjacent pavers within a 1/32" tolerance.
4. Pavers laid out in radial rows shall follow the overall curve smoothly without wobbling, with the centerline of each paver located within a 1/16" tolerance of the overall radius.

E. Joint Pattern shall be as indicated on drawings and approved by the Commissioner.

F. Expansion and Control Joints: Provide sealant-filled joints at locations and of widths indicated. Provide joint filler as backing for sealant-filled joints where indicated. Install joint filler before setting joints. Sealant to match adjacent paving and to be approved by the Commissioner.

G. Install edge restraints or headers as indicated, and as detailed in drawings.

3.6 SAND SETTING BED APPLICATION

A. Spread the bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1 ½ in. (40 mm) thickness. The screeded sand should not be disturbed. Sufficient sand shall be placed in order to stay ahead of the laid pavers. Do not use the bedding sand to fill depressions in the base surface.

B. The spread sand shall be carefully maintained in a loose condition, and protected against incidental compaction, both prior to and following screeding. Any incidentally compacted sand or screeded sand left overnight, shall be loosened before further paving units are placed. Sand shall be lightly screeded in a loose condition to the predetermined depth, only slightly ahead of the paving units. Under no circumstances shall the sand be screeded in advance of the laying face to an extent to which paving will not be complete on that day.

C. Screed sand shall be fully protected against incidental compaction, including compaction by rain. Any screeded sand which is incidentally compacted prior to laying of the paving unit, shall be removed and brought back to profile in a loose condition. Neither pedestrian nor vehicular traffic shall be permitted on the screeded sand.

D. The Contractor shall screed the bedding sand using either an approved mechanical spreader (e.g.: an asphalt paver) or by the use of screed rails and boards.

E. Pavers shall be free of foreign material before installation.

F. Pavers shall be inspected for color distribution and all chipped, damaged or discolored pavers shall be replaced.

G. The pavers shall be laid in the pattern(s) as shown on the drawings. String lines or chalk lines on bedding sand should be used to hold all pattern lines true.

H. Pavers to be placed along the edge shall be cut with a double blade paver splitter or masonry saw.

I. Upon completion of cutting, the area must be swept clean of all debris to facilitate inspection and to ensure pavers are not damaged during compaction. (Debris or sand particles left on pavers which are being compacted can cause point loading which may chip, scrape or break the paver.)

J. After sweeping and prior to compaction, the paved area must be inspected by the Commissioner to ensure satisfactory color blending. Pavers can be moved easily at this time to achieve good color distribution.

K. Low amplitude, high frequency plate compactor shall be used to compact the pavers into the sand. The compactor shall transmit an effective force not less than 75 kN per square metre (1600 Lb/ft^2) of plate area. The frequency of vibration shall be within the range of 75 to 100 Hz. Use Table 5 below to select size of compaction equipment:

TABLE 5
PAVER THICKNESS AND REQUIRED MINIMUM
COMPACTION FORCE

Paver Thickness	Compaction Force
2 3/8 in. (60 mm)	3000 lbs [13 kN]
2 3/4 in. (70 mm) & 3 1/8 in. (80 mm)	5000 lbs [22 kN]

Note: Use of a urethane plate compactor pad is recommended to minimize any scuffing of

the paving stone surface.

L. The pavers shall be compacted to achieve consolidation of the sand bedding and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic or application of sweeping sand.

M. Any units that are structurally damaged during compaction shall be immediately removed and replaced.

N. Dry joint sand shall be swept into the joints until the joints are full. This will require at least two or three passes with the compactor. Do not compact within 3 ft. (1 m) of the unrestrained edges of the paving units.

O. All work to within 3 ft. (1 m) of the laying face must be left fully compacted with sand-filled joints at the completion of each day.

3.7 MORTAR SETTING BED APPLICATION

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimum performance characteristics.

B. Latex-Modified Mortar: Proportion and mix mortar and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

C. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

D. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.

E. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated

F. Spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

G. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

H. Wet pavers before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

I. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- thick bond coat to mortar bed or to back of each paver with a flat trowel.

J. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver

in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

K. Spaced Joint Widths: Provide a hand-tight joint not to exceed 1/16" joint width.

L. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer. recommended by grout or liquid-latex.

3.8 REPAIRING, AND CLEANING

A. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating as recommendted by coating manufacturer and as acceptable to paver and grout manufacturers.

2. Do not allow protective coating to enter drains.

B. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

C. Protect paving from damage due to related construction operations, by other contractors, trades and trespassers. Treat, repair or replace damaged work as directed.

3.9 FIELD QUALITY CONTROL

A. Final elevations shall be checked for conformance to the drawings after removal of excess joint sand.

B. All surface and pavement structures shall be true to the lines and levels, grades, thickness and cross sections shown on the drawings. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels. In no case shall the cross-fall of any portion of pavement be less than 1 percent. The final surface elevations shall not deviate more than 3/8 in. under a 10 ft. long straight edge.

C. The surface elevation of the pavers shall be 1/8" to 1/4" above adjacent drainage inlets, concrete collars or channels.

3.10 PAVEMENT PROTECTION

A. Protect pavement against damage prior to final acceptance by the Commissioner. Repair any damage to pavement at no cost to the City. Keep pavement carrying traffic or equipment clean. Protect against spillage of any deleterious materials.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus pavers, and waste material, include excess setting bed materials, unsuitable soil, trash, and debris, and legally dispose of it off the City of New York's property.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 321613

CONCRETE CURBS AND SIDEWALKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Examine all drawings and other sections of the specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, facilities needed to perform excavation, backfill, trenching, forming as necessary to construct the on-site and off-site concrete curb, gutters and sidewalks as shown on the Contract Drawings or as directed by the Commissioner.

1.3 RELATED SECTIONS

A. Section 321216 - Bituminous Pavement

B. Section 321217 - Aggregate Overlay Over Asphalt

C. Section 321313 - Cast-in-Place Concrete Paving

D. Section 321314 - Cast-in-Place Concrete Paving – Pervious

1.4 DESIGN REQUIREMENTS

A. Concrete curbs and sidewalks which are under jurisdiction of New York City DOT, even though constructed as part of this contract, shall be constructed in accordance with the Rules and Regulations, Standard Details and Standard Specifications of NYC DOT Standard Specifications section 4.08, 3.05, as further defined in the Contract Drawings and Specifications.

B. Concrete for curbs and sidewalks which are inside the property line of the site and not under the jurisdiction of other City agencies shall be concrete, proportioned, mixed, placed, cured and protected.

C. Concrete for curbs and sidewalks shall be:

1. Class A, have a minimum 28-day compressive strength of 4,000 psi.
2. Slump values: 2 inch minimum to 4 inch maximum.
3. Air content 5 to 7%

4. Minimum cement content (94 lb sacks per cy): 6.0

5. Maximum water-cement ratio by weight: 0.48

1.5 SUBMITTALS

A. The Contractor shall furnish all working drawings and material specifications for the approval of the Construction Manager in accordance with the requirements of the General Conditions.

B. The Contractor shall submit marked-up drawings and shop drawings including shop and field test reports of concrete samples tested in an approved laboratory.

C. The Contractor shall submit test results of the concrete testing and sampling in writing to the Commissioner on the same day tests are completed.

D. The Contractor shall submit manufacturer's product data including reinforcement and related materials.

E. The Contractor shall submit two copies of laboratory test or evaluation reports for concrete materials and mix designs at least 5 days prior to start of work. Do not begin concrete production until mixes have been reviewed and are acceptable to Commissioner.

F. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material

listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete:

1. Portland Cement: ASTC C150, Type 1
2. Coarse aggregate: ASTM C33, maximum aggregate size shall be 3/4 inch.
3. Water: Clean, drinkable
4. Air-entraining mixture: ASTC C260
5. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 - General Requirements.

B. Reinforcing:

1. Welded Wire Fabric: ASTM A185, #6 gauge, 6x6
2. Structural steel: ASTM A36.

C. Crushed Stone or Gravel: Washed, size ¼" to ¾"

D. Membrane-forming curing compound: ASTM C309, Type I.

E. Preformed expansion joint filler: Type IV as described in Section 2.15 of the Standard Specifications of the New York City Department of Transportation, Bureau of Highway Operations.

F. Joint sealing compound for horizontal joints shall be asphaltic blown joint filler as described in Section 2.16 of the Standard Specifications of the New York City Department of Transportation.

G. Form materials: with sufficient stability to withstand pressure of placed concrete without bow or deflection.

2.2 SOURCE QUALITY CONTROL

A. Concrete shall be tested and evaluated for strength and acceptance in accordance with:

1. Sampling: ASTM C172
2. Slump: ASTC C143 one test per each load at point of discharge
3. Air Content: ASTM C173
4. Compressive Strength: ASTC C39. One specimen tested at 7 days, one specimen tested at 28 days, and one retained for later testing if necessary.
5. Measuring, mixing, transporting and placing concrete: ACI 304
6. Concrete curbs and sidewalks shall have a Solar Reflective Index (SRI) equal to or greater than 29 when tested in accordance with ASTM E 1980"

PART 3 - EXECUTION

3.1 SIDEWALK INSTALLATION

A. Concrete sidewalk shall be of the width shown or otherwise specified and shall be laid on 6 inches thick compacted broken stone base, unless otherwise specified or shown on the Contract Drawings.

B. Sidewalk shall consist of a single course of concrete 4 inches thick, unless otherwise shown on the Contract Drawings.

C. Concrete shall be pigmented when required by the detailed specifications.

D. Excavation and subgrade preparation shall be in accordance with the requirements of Specification 312000 "Earthwork". All existing material within the required 6 inches of foundation shall be removed in its entirety. Additional depth of foundation material for special conditions shall be placed as required by the Construction Manager.

E. Materials: Foundation material shall be placed on the prepared subgrade and thoroughly compacted into a course not less than 6 inches thick. The top surface shall be parallel to the finished grade and at a distance below the grade equal to the specified thickness of concrete.

F. Slabs: Concrete sidewalk shall be built in approximately 20-foot lengths between expansion joints. The sidewalk shall be separated from adjoining structures by expansion joints. Expansion joints in sidewalk shall coincide with expansion joints in curb. Tooled control joints not less than 1/2 inch in depth shall be provided where at four foot intervals unless otherwise shown on the Contract Drawings.

G. Reinforcement: Position, support and secure reinforcement against displacement. Welded wire fabric shall be 2" from bottom of slab. Install welded wire fabric in as long length as practical, lapping at least one mesh.

H. Expansion Joints: Transverse expansion joints shall be 1/2 inch in width and shall be filled with material approved by the Construction Manager.

I. The foundation material shall be wetted immediately before concrete is placed. The concrete shall be placed within the forms and thoroughly tamped until the surface is at the finished grade.

J. When specified in the detailed specifications, the concrete sidewalk shall be pigmented with a minimum of 2 pounds of dispersed carbon black per bag of cement to produce a bluestone color. The coloring pigment shall either be treated so as not to cause an increase or decrease of the entrained air content in cement mortar or in the concrete of more than 10 percent, or the amount of air-entrainment agent added to the concrete shall be adjusted to meet the specified requirements. All cement used for concrete work specified herein shall be of uniform color. Match the color of the existing concrete where new concrete will meet the existing curb and sidewalk in the street.

K. Each rectangular slab shall have all edges neatly rounded with proper tools and be bounded on all sides by a troweled border about 1 inch in width. Surface texture of pedestrian ramps shall be transverse grooves, 1/2 inch wide by 1/4 inch deep on 2-inch centers.

L. Backfilling shall follow the removal of forms as soon as practicable and, unless otherwise permitted, shall be of clean earth, satisfactorily compacted.

M. Forming and Placing Concrete: Use drum-type batch machine mixer, mixing not less than 1-1/2 mm for 1 cubic yard or smaller capacity. Increase mixing time at least 15 second for each additional cubic yard or fraction thereof.

3.2 CURB INSTALLATION

A. Concrete and steel face curbs shall be constructed in accordance with the applicable provisions of Sections 4.08 and 4.09, Standard Specifications of the New York City Department of Transportation, Bureau of Highway Operations. Match the color of existing curb within the public right-of-way.

B. Expansion joints of ½" cellulose or similar material shall be placed at 10-ft intervals. Curbs shall be installed at 10-ft sections.

C. Depressed curb and handicap ramps shall be provided where specified or shown on the Contract Drawings.

END OF SECTION 321613

This Page Intentionally Left Blank

SECTION 327200

PLANTINGS FOR WETLAND AREAS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work included: This work includes but is not limited to the following:

1. Furnishing and installing new shrubs and all other plant materials.
2. Furnishing and installing coir fiber blanket.
3. Furnishing and installing waterfowl exclusion barrier.
4. Protection and service of all plant materials until Substantial Completion.
5. Guarantee of all new plant materials for a period of 24 months.
6. Service of plantings during the 24 month guarantee period.

1.3 RELATED SECTIONS

A. Excavation and Fill - Section 312300

B. Erosion and Sedimentation Controls – Section 312500

C. Coir Fiber Blanket – Section 327300

D. Waterfowl Exclusion Barrier – Section 327400

E. Soil Mixes for Wetland areas – Section 327500

F. LEED Certification Requirements – Section 013010

G. Construction Waste Management – Section 017330

1.4 REFERENCES

A. AAN – American Association of Nurserymen

B. ASNS – "American Standard for Nursery Stock," ANSI Z60.1 latest edition, published by the American Associate of Nurserymen, (AAN)

1.5 QUALITY ASSURANCE

A. The Contractor or Subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

1.6 SUBMITTALS

A. Product Data

1. Submit certified analysis for each treatment, amendment, and fertilizer material specified and as used. Include guaranteed analysis and weight for packaged material. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

B. Documentaion: The Contractor shall submit written documentation at least 30 days prior to scheduled start of planting that all plant material has been ordered.

C. Service Program: Submit written schedule of service operations proposed for the guarantee period. Schedule shall be in the form of a list of each service operation, with dates showing when each service task will be performed, and the frequency of occurrence.

D. LEED Submittals Requirements:

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 013010 LEED Certification Requirements). Information for this Form shall include:

a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post – industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Packaged Materials

1. Deliver packaged materials in unopened bags or containers, each clearly bearing the name of the producer, the material composition, manufacturers' certified analysis, and the weight of the material.

2. All packaged products shall be stored, handled and applied in strict accordance with manufacturers instructions.

B. Dig and handle all plant material to prevent injury to trunks, branches and roots.

1. Do not prune prior to delivery.

2. Do not bend or bind-tie trees in such manner as to damage bark, break branches or destroy natural shape.

C. Pack and ship all plant material to ensure arrival at site in good condition. Provide protective covering during delivery.

D. If planting is delayed more than 24 hours after delivery, Contractor shall provide adequate means of protection from freezing and from the drying effects of wind and sun.

1. Rootballs shall be protected with soil, wet mulch, or other acceptable material.

2. Provide shade structures or other covering as required to protect branches and leaves.

3. Water as necessary until planted. Do not allow plant material to wilt or show signs of stress from lack of water. Provide all water and equipment for water distribution at no additional cost to the City.

E. Immediately remove rejected or damaged plant material from the site and replace with plants approved by Commissioner. All replacement plants shall be subject to the same requirements as the original material.

1.8 COORDINATION

A. The Contractor shall coordinate his work with that of other Contractors. Such coordination shall include, but not be limited to:

1. Location of all underground utility lines and structures

2. Scheduling of planting operations

3. Scheduling of service operations

1.9 MOCK UP – CELL 1

A. Cell 1 shall be planted in full and hydrated to weir level before commencing any planting in Cells 2-5. The Commissioner will assess soil moisture in each planting

zone over the span of three weeks and shall verify that soil moisture levels are adequate for plant survival in each planting zone prior to construction of Cells 2-5.

1.10 PLANT SELECTION AND INSPECTION

A. Contractor shall locate all plant materials and provide documentation to verify source of all plant material at least 6 months prior to proposed delivery.

B. Inspection at Nursery: All plants will be inspected and selected by the by Contractor at the nursery for conformity to specification requirements.

C. Inspection at Delivery - On Site: Notify the Commissioner at least five (5) working days in advance of delivery of plants to the site.

1. The Commissioner may inspect all plants upon delivery to site.

2. Contractor shall schedule a time for on-site inspection prior to planting, and shall arrange for adequate labor and equipment on-site at the time of inspection to unload, open, and handle plants during inspection.

3. The Commissioner may reject any plant material prior to or upon delivery to the site.

a. All plant material that is dead, dying or appears unhealthy will be rejected.

b. All plant material that has been improperly maintained, transported or handled in such a way as to impair its appearance or health will be rejected.

c. All plant material that is underdeveloped, immature will be rejected. Minimum above ground heights for each specified size are: 2 inch diameter plug (Herbaceous Floodplain, Wet Meadow and Riparian Herbaceous) > 6 inches, 2 inch diameter plug (Shallow Marsh) > 12 inches, bare root > 6 inches, #1 cont.(Riparian Herbaceous) > 6 inches, #1 cont.(Shrubs) > 14 inches, #2 cont.(Shrubs) > 18 inches.

D. The Commissioner will be the sole judge of the condition of the plants.

1. All material which is rejected on-site shall be removed immediately from site, and replaced with new material selected by the Commissioner, at no additional cost to the City.

1.11 INITIAL LAYOUT

A. Contractor shall submit a written request to the Commissioner, for a formal inspection of the planting work for Initial Layout.

B. At the time of inspection the locations of all planting zones shown on plans must be laid out with stakes and lines.

1. Revisions to planting zones shall be made as necessary in the opinion of the Commissioner.

1.12 SUBSTANTIAL COMPLETION

A. Contractor shall submit a written request to the Commissioner, for a formal inspection of the planting work for Substantial Completion.

B. At the time of inspection all plant material must be alive, healthy, and installed as specified to be accepted.

1. If plants are dead, dying, unhealthy, or not serving their visual function in the landscape scheme in the opinion of the Commissioner, or if workmanship is unacceptable, written notice will be given to the Contractor in the form of a punch list which itemizes all remedial work required for Substantial Completion.

2. This work may include plant replacement or service and must be carried out prior to issuance of the Certificate of Substantial Completion.

1.13 GUARANTEES

A. All new plant material shall be guaranteed for a period of 24 months after the date of Substantial Completion.

B. Service

1. Contractor shall submit a written service program and schedule to the Commissioner for approval.

2. Service program shall be revised and resubmitted as required until approved by Commissioner.

3. During the guarantee period, the Contractor shall maintain all plant materials as specified herein, and as noted in the approved service schedule, and shall replace, at no additional cost to the City, any and all plant material that has died or, in the opinion of the Commissioner, is in unhealthy or unsightly condition.

C. Replacements

1. There will be no limit to the number of times replacements are made of individual plants, unless conditions causing the failure can be proved to be beyond the control of the Contractor.

2. All replacements shall be in accordance with original Specification.

3. Cost of all replacements shall be included in the Contract price. No additional payment will be made therefore.

4. Replace unacceptable plant material no later than the next succeeding planting season.

5. Replace unacceptable plant material no later than the next succeeding planting season.

6. All areas damaged or soiled by replacement planting operations are to be fully restored to their original condition at no additional cost to the City.

D. Site Inspection

1. Approximately one month prior to the expiration of the guarantee period, the Contractor shall arrange a site inspection by the Commissioner.

2. The Commissioner will prepare a list of all remedial work required, including plant replacement or service.

3. This work shall be carried out before the end of the guarantee period, unless weather conditions cause delays, in which case such work shall be carried out as soon as is practical.

E. Final Acceptance

1. Following the completion of all remedial work and replacement plantings, the Contractor shall request the Commissioner in writing for a formal inspection of the landscape work for Final Acceptance.

2. If replacement plantings are required, Final Acceptance will be provisional upon a final inspection at the end of the guarantee period for the plant replacements.

F. All of the materials and labor required for service and replacements during the guarantee period shall be included in the Contractor's bid price. No additional payments will be made therefor.

1.14 LEED PERFORMANCE REQUIRMENTS

A. Plants grown within 500 miles of the project site shall be documented in accordance with Section 013010.

1.15 QUALIFICATIONS

A. Submit a Statement of Qualifications for the Landscape Contractor. Qualifications shall show experience in the installation of wetland landscapes of a similar type and scale to this project within the last three years.

B. Statement of Qualifications shall consist of the following information:

1. Company name and address

2. Number of years in business under this name

3. Number of current full-time, part-time, and seasonal employees

4. Estimated number of employees intended for this project

1.16 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary for work to comply with such requirements at no additional cost to the City

PART 2 PRODUCTS

2.1 PLANT MATERIAL

A. Provide plant material to meet or exceed applicable AAN standards in all ways in addition to other standards specified. Plants shall be true to species and cultivar specified. Plants shall be typical of their species or variety with normal habits of growth, in accordance with ASNS: Sound, healthy and vigorous, well-branched and densely foliated when in leaf, free from disease, insect pests, eggs or larvae with healthy well developed root systems.

B. All plants shall be species native to the Eastern United States. Plants that have escaped cultivation, or have accidentally been introduced into native habitats, shall not be considered native to the Eastern United States.

1. All plants shall be nursery grown.

2. No plant material shall be collected or harvested from non-nursery areas.

3. All trees shall be freshly dug for this project.

C. Sources: Nursery sources of supply shall have been investigated by the Contractor prior to submitting bid to confirm that size, variety, and quantity of plant material specified on Plant List can be supplied. Failure to take this precaution will not relieve the Contractor from the responsibility for furnishing and installing all plant material in strict accordance with the Contract requirements and without additional expense to the City. The following are recommended sources of plant material:

1. Greenbelt Native Plant Center, 3808 Victory Blvd, Staten Island, NY 10314. (718) 370-9044

2. Pinelands Nursery, 323 Island Rd, Columbus, NJ 08022. (609) 291-9486

3. Southern Tier Consulting and Nursery, 2701-A Rte 305, West Clarksville, NY 14786. (585) 968-3120

D. Quality: All plant material shall be nursery grown in accordance with good horticultural practice, for at least two years under climatic conditions and soils similar to those at project site. All plants shall be of specimen quality. All trees are to be uniform and matched. All trees shall have straight trunks with leader intact, undamaged and uncut. Trees with a damaged or crooked leaders, bark or abrasions, sun-scald, disfiguring knots, insect damaged will not be accepted.

E. Size

1. All plants shall meet specified minimum size requirements.

2. Plants that meet measurements but do not possess a normal balance between height and spread shall be rejected.

3. Plants larger than specified may be used only if approved by Commissioner. Use of such plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant. Contractor shall verify that size of root ball will fit in prepared planting pits.

2.2 WATER

A. The Contractor shall be responsible for supplying all required water to the site at no additional cost to the City.

1. All work injured or damaged due to the lack of water, or the use of too much water, or contaminated water shall be the Contractor's responsibility to correct.

2. Water shall be free from impurities injurious to vegetation.

B. The hydrology of wetland Cells 1-5 will be tested during construction

1. Water shall flow freely over weirs during hydrology test, dewatering may be required for Cell 7.

2. Hydrology shall be tested in Mock up – Cell 1 prior to Cells 2-5, water shall flow freely over Cell 1 Weir during evaluation period and temporary runoff shall be routed to sedimentation pond.

C. Water shall flow freely over weirs in Cells 1-5 before planting and throughout the service and guarantee period. Contractor shall be responsible for artificially maintaining water levels at weir level if water flow is disrupted at any point during guarantee period.

PART 3 EXECUTION

3.1 INSPECTION

A. Contractor shall inspect the site before bidding to determine the characteristics of the site.

B. The Contractor shall be liable for all damage to surrounding areas caused by planting operations and shall be required to restore or replace the damaged areas to their original condition.

3.2 UTILITIES

A. Contractor is responsible for determining the location of all utilities, by contacting the appropriate utility company prior to any planting activities..

B. Verify that underground utilities and irrigation systems in landscape areas are in place, at proper location, tested (except final irrigation testing) and ready for use.

1. Take proper precautions so as not to disturb or damage sub-surface elements.

2. Coordinate with other trades.

C. Contractor is liable for any damage to such utilities during the course of construction, and is responsible for making necessary repairs to damaged utilities at his own expense.

3.3 PLANTING DATES

A. Plant only within the following dates, weather permitting. Do not plant in times of high wind, rain, sleet or snow, or when the ground is frozen or the soil is otherwise in an unsatisfactory condition for planting. Planting at times other than those specified will be at the Contractor's own risk, and will not invalidate any Guarantees.

1. Container-grown perennials, vines, ground cover plants, and wetland plugs:

a. Spring: April 15 to May 15

3.4 PREPARATION FOR PLANTING

A. Planting Soil Mixes materials and installation shall be as specified in Section 327500 – Soil Mixes for Wetland Areas.

B. Install Coir Fiber Blanket on top of soil in areas shown on drawings.

1. See Section 327300 – Coir Fiber Blanket

C. Exercise extreme caution during excavation to avoid damaging or interrupting existing underground utilities. Use appropriate detection equipment to locate utilities during excavation for planting.

D. Erect barricades, warning signs, or other protective devices as may be required by local, state, or federal laws and regulations to protect open excavations.

3.5 PLANT INSTALLATION

A. Do not plant until plant material has been approved by the Commissioner at site.

B. Placement of Plants

1. Plants shall be set in the center of pits, plumb and straight, in accordance with the planting details, and faced to give best appearance and relationship to adjacent plants and structures.

2. Plant to such depth that the finished grade level of plant, after settlement, will be the same as that at which the plant was grown.

C. Planting perennials, vines and container grown shrubs

1. Excavate plant holes to depth of container and twice the container diameter.

2. Carefully remove plant from container using gentle handling to avoid damage to any part of plant.

3. If roots are loose, spread roots out evenly over a mound of soil mix. If roots are tight and compact, loosen by pulling gently apart. If plant roots will not separate, use a sharp tool to make vertical slits in the root ball, approximately 1/2-inch deep at three or four locations around root mass.

4. Set plants on a bed of compacted soil mix, so that the root ball is level with the surface of the soil.

5. Backfilling: Fill plant pit with soil mix by hand, pushing the mix around and just over the surface of the root ball. Add soil mix in layers not more than four inches (4") deep, and with each layer thoroughly settled by hand tamping and with water, and free of all voids before next layer is put in place.

D. Saucering

1. After backfilling is completed, a saucer shall be made for the retention of water around each plant, unless impracticable due to placement of tree gratings or other paving material over planted area.

2. The saucer shall be of the same diameter as that of the hole dug.

3. The lip shall be level all around and shall be at least 4 inches high for trees, and 2 inches high at shrubs.

E. Planting wetland plugs in aquatic areas

1. Follow specific species planting instructions called out below as applicable. Otherwise follow procedure described below:

2. Excavate plant holes to depth of plug and twice the plug diameter. Tear small hole in Coir Fiber Blanket and move aside to create space for plug. Do not tear fiber blanket excessively.

3. Carefully remove plant from container using gentle handling to avoid damage to any part of plant.

4. If roots are loose, spread roots out evenly over a mound of soil mix. If roots are tight and compact, loosen by pulling gently apart. If plant roots will not separate, use a sharp tool to make vertical slits in the root ball, approximately 1/2-inch deep at three or four locations around root mass.

5. Set plants upright in excavated hole so that the root ball is level with the surface of the soil.

6. Backfilling: Fill plant pit with soil mix by hand, pushing the mix around and just over the surface of the root ball. Add soil mix in layers not more than four inches (4") deep, and with each layer thoroughly settled by hand tamping and with water,

and free of all voids before next layer is put in place. Smooth disturbed Coir Fiber Blanket back into place adjacent to plug.

7. If plugs float to water surface immediately after planting, sod staples may be used to secure plugs.

8. Floating plants spotted around the water's edge more than 24 hours after planting indicate unsuccessful planting.

3.6 WATERING

A. Water areas immediately after planting is complete.

1. Apply water slowly so as to penetrate the entire root system.

2. Watering shall continue throughout the service and guarantee period, as frequently as seasonal conditions require, until final acceptance of the work.

a. Watering is only required for planting areas above standing water elevation.

3. Contractor shall be responsible for adequate water both before and after installation of irrigation system.

3.7 WATERFOWL EXCLUSION

A. Waterfowl exclusion fencing shall be installed around wetland areas immediately after planting is complete.

1. See Section 327400 – Waterfowl Exclusion Barrier

3.8 PRUNING

A. Perform compensatory pruning of shrubs following planting.

1. Excessive pruning at the time of transplanting must be avoided. The extent of top pruning should be based upon the ability of the plant roots to function.

2. All deadwood, suckers, broken or badly bruised branches shall be removed.

3. Pruning shall be done with clean, sharp tools.

4. No leaders shall be cut. Each cut shall be made carefully, at the correct location, leaving a smooth surface with no jagged edges or torn bark. The correct anatomical location is just beyond the branch collar.

5. Large or heavy limbs should be removed using three (3) cuts. The first cut undercuts the limb one or two feet from the parent branch or trunk. The second cut is top cut which is made slightly further out on the limb than the undercut. The third cut is to remove the stub.

3.9 ANTIDESICCANT SPRAYING

A. Use antidesiccant only as approved by Commissioner. Approval is required for each condition of use.

3.10 PLANT PROTECTION

A. The Contractor shall provide at his own expense all protection he deems necessary for all plants and lawn areas against damage prior to Final Acceptance of the work.

B. Removal of Temporary Protection Measures: All temporary protection measures employed during the construction period shall be removed prior to Substantial Completion unless otherwise directed by the Commissioner. All guys, arbor tie or stakes used for temporary bracing of trees or any tree trunk wrapping shall be removed and disposed of by the Contractor off site at his own expense at the end of the guarantee period, or earlier at the direction of the Commissioner.

3.11 PLANT SERVICE

A. Service of all plant material shall begin immediately after planting, and continue until the end of the guarantee period, unless otherwise noted.

B. Defective work shall be corrected as soon as possible after it becomes apparent and weather season permits. The Commissioner shall be the sole judge of the condition of the plants.

C. Service shall include:

1. Watering, re-planting, repair of ruts and erosion, repair of protection devices, weeding, and fertilizing.

2. The removal of all dead, dying or unhealthy plant material, and replacement of such material with new plants to meet all specifications of the original plantings.

3. The repeating of any or all phases of planting as specified herein, or which may be required to obtain healthy, densely vegetated wetland areas.

D. Service Program

1. Contractor shall arrange a meeting with the Commissioner, and with City's designated service personnel to review together the submitted service program and any modifications required for the duration of the guarantee period.

2. The Contractor shall make periodic inspections, at no extra cost, during the guarantee period to determine what changes, if any, should be made in the service program.

3. Any recommended changes shall be submitted in writing to the Commissioner

4. Additional remedial work not included in the service program shall be carried out by the Contractor as deficiencies are identified and reported by the Commissioner or designated service personnel.

5. The Contractor shall replace, at no additional cost to the City, as soon as weather conditions permit, and within a specified planting period, all plants determined dead and/or dying by City's designated service personnel during and at the end of the guarantee period.

6. Plants shall be free of dead or dying branches and shall bear foliage of normal density, size, and color.

7. Replacements shall match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Labor and all materials needed for installation of replacements shall be included in the guarantee.

8. The guarantee of all replacement plants shall extend for an additional period of 24 months from the date of their acceptance after replacement.

E. Service Tasks: Service shall include, but not be limited to the following:

1. Watering: Water planted areas as required. Do not permit plant material to wilt or to show signs of stress from lack of water. Contractor shall supply and distribute water to plantings during the full time of their establishment at the site and provide all equipment for water distribution and water at no additional cost to the City. Plants shall be inspected by the Contractor for watering needs at least once each week, and watered as necessary to promote plant growth and vitality.

2. Fertilizers: Fertilizers, pesticides and fungicides may only be used with approval from Commissioner.

3. Rodents: Protect against and exterminate rodents, and repair of any damage caused by rodent activities.

4. Weeding: Weed to keep all planted areas weed-free throughout the guarantee period.

5. Resetting: Reset plant material which has settled, to proper grade and position.

6. Irrigation: Coordinate with irrigation system installer for all adjustments to irrigation as required.

7. Instruct City's service personnel in all service procedures.

3.12 CLEAN UP

A. At the end of each work day the Contractor shall broom-clean the site, to remove all trash, debris, and loose soil materials. Store materials and equipment where directed.

B. Immediately following the completion of planting operations, the Contractor shall remove all excess materials, stock piles, waste material, tools and equipment, and leave the site in a clear and clean condition.

C. Immediately remove all rejected materials from the site. All rejected materials and other waste or debris shall become the property of the Contractor, who shall legally dispose of same off-site.

END OF SECTION

SECTION 327300

COIR FIBER BLANKETS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall provide all equipment, labor, materials and incidental items necessary to furnish and install erosion control Coir Fiber Blanket as indicated on the Contract Drawings and as specified herein.

B. Installation of Coir Fiber Blanket includes, but is not limited to:

1. Coverage of wetland soil surface in Wetland Cells 1, 2, 3 and 4.

C. The Contractor shall be responsible for any damage due to his work and for any corrective action or repairs needed to restore any damaged structure or facility to its condition prior to the start of work.

1.3 RELATED SECTIONS

A. Plantings For Wetland Areas – Section 327200

B. LEED Certification Requirements – Section 013010

C. Erosion, and Sedimentation Controls – Section 312500

D. Construction Waste Management – Section 017330

1.4 QUALITY ASSURANCE

A. The Contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 SUBMITTALS

A. Contractor shall submit one (1) 2' x 2' sample of proposed Coir Fiber Blanket product.

B. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 013010 LEED Certification Requirements). Information for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post – industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.7 MOCK UP – CELL 1

A. Coir Fiber Blanket shall be included in Cell 1.

1.8 LEED PERFORMANCE REQUIRMENTS

A. Coir Fiber Blanket shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 LEED Requirements Section.

B. Coir Fiber Blanket materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Section 013010, Part 2, where applicable.

1.9 QUALIFICATIONS

A. The installation of Coir Fiber Blanket shall be performed by the Contractor or a specialty subcontractor specializing in and/or having experience installing erosion control measures in wetlands.

PART 2 PRODUCTS

2.1 MATERIALS

A. Coir Fiber Blanket: Coir Fiber Blanket shall be 100% biodegradable woven matting of coir made from high strength coconut fiber. Coir Fiber Blanket shall be open weave erosion control webbing with non-shifting square mesh consisting of one hundred (100) percent coir fiber yarns in both the warp and the weft, with a minimum weight of twenty ounces (20 oz.) per square yard. Mat shall have 50% open space. Coir Fiber Blanket shall be Coir Mat 700, at least six (6) feet in width or an alternate width approved by the Commissioner or approved equal. The following are recommended sources of coir fiber blankets:

1. Pinelands Nursery, 323 Island Rd, Columbus, NJ 08022. (609) 291-9486

2. East Coast Erosion Control, 443 Bricker Rd, Bernville, PA. (610) 488-8496

3. Hanes Geo Components, 104 Sunfield Ave, Edison NJ 08837. (732) 343-7740

B. Sod Staples: Sod Staples shall be less than 6" long, 11 gauge galvanized wire.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Coir Fiber Blanket shall be installed and stapled at the direction of the Commissioner, in accordance with the manufacturer's recommendations and staple pattern guide.

3.2 PREPARATION

A. Prior to installation operations, the Contractor shall confirm that the area of work has been graded to the proper lines and grades as indicated in the plans and specifications, and to the satisfaction of the Commissioner.

3.3 INSTALLATION

A. Coir Fiber Blanket shall be laid along the wetland soil surface prior to planting, in accordance with the plans and specifications. Rows of fabric shall be joined by overlapping of adjacent sections of fabric, the sections shall be overlapped a minimum of 4 inches with the upstream Coir Fiber Blanket end over-lapping the downstream end. Coir Fiber Blanket shall be placed tightly and in full contact with the soil.

B. Coir Fiber Blanket shall unroll to its full width and length and be anchored at ends as well as twice per square yard. Coir Fiber Blanket shall be anchored with sod staples. Excess Coir Fiber Blanket shall be cut away and the top edge trenched and buried to a depth of six (6) inches and anchored with staples.

C. Installation of the Coir Fiber Blanket shall occur prior to the installation of Planting, where applicable and in accordance with the plans, specifications, and directions of the Commissioner.

END OF SECTION

SECTION 327400

WATERFOWL EXCLUSION BARRIER

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. The Contractor shall provide all equipment, labor, materials and incidental items necessary to fabricate, install, and maintain Waterfowl Exclusion Barrier as indicated on the Contract Drawings and as specified herein.

B. Installation of Waterfowl Exclusion Barrier includes, but is not limited to:

1. Protection of planted Wetland planting area through establishment.

C. The Contractor shall be responsible for any damage due to his work and for any corrective action or repairs needed to restore any damaged structure or facility to its condition prior to the start of work.

1.3 RELATED SECTIONS

A. Planting For Wetland Areas – Section 327200

B. LEED Sustainability

C. Dust, Soil Erosion, and Sedimentation Control – Section 312500

D. DDC General Conditions

1.4 QUALITY ASSURANCE

A. The contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 SUBMITTALS

A. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 013010 LEED Certification Requirements). Information for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post – industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on LEED MATERIALS REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, regional content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.7 QUALIFICATIONS

A. The installation of Waterfowl Exclusion Barrier shall be performed by the Contractor or a specialty subcontractor specializing in and/or having experience installing waterfowl control measures.

1.8 MOCK UP – CELL 1

A. Waterfowl Exclusion Barrier shall be included in Cell 1, in conjunction with planting.

1.9 LEED PERFORMANCE REQUIREMENTS

A. Waterfowl Exclusion Barrier shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 LEED Requirements Section.

B. Waterfowl Exclusion Barrier materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 LEED Requirements Section.

C. All field-applied adhesives, sealants, paints and coatings relating to work of this section that are used on the interior of the building (defined as inside of the waterproofing system) shall meet the requirements of Section 013010, Part 2, where applicable.

D. All wood materials to be FSC certified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fence Posts: 2" x 2" x 8' stakes of pointed tipped, untreated FSC-certified hardwood timber.

B. Nylon Monofilament Line: Nylon mason's line, eighty - one hundred pound test minimum, of sufficient flexibility to wrap tightly around posts.

C. Surveyor's Ribbon: White or brightly colored surveyor's ribbon.

D. Fencing: Black polypropylene goose exclusion fencing, with horizontal and vertical lines and an aperture size of 0.75" to 1"; or approved equal.

E. Nails: Two-inch hot dipped galvanized roofing nails.

PART 3 EXECUTION

3.1 GENERAL REQUIRMENTS

A. The waterfowl barrier fence shall be installed before or immediately after planting of the wetland areas.

3.2 INSTALLATION

A. The timber posts shall be spaced six to eight feet apart and pounded into the substrate to a minimum depth of two feet. No posts shall be installed in areas covered by wetland liner. The fencing material shall be taut and stapled with no space between the ground and bottom edge of fencing. If necessary, fencing can be partially buried in substrate. Nylon mason's line shall be strung between posts, beginning not more than eight inches above the fencing material.

B. Nylon mason's line shall be attached to each post by wrapping the line a minimum of four times around a two-inch nail that extends into the post by a minimum of 1.25 inches. The topmost line shall be attached to nails hammered down into the top of the post, and additional horizontal nylon lines shall be spaced no more than eight inches apart. The fence shall extend around the perimeter of the planting area except locations where site wall or gabion, at least 4 feet high, is present. The outer fence shall be installed a minimum of 18 inches away from the first row of plants.

C. Pieces of surveyor's ribbon shall be tied to the monofilament line at three-foot intervals. Ribbon must be wrapped twice around line before knotting to prevent slippage.

D. Additional monofilament lines shall be tied to the tops of each stake, crossing horizontally over the cell to an opposite stake, creating an eight-foot weave above the planting zone. These cross-lines must also be tied with surveyor's ribbon at the same three-foot interval to prevent entry by birds from the air.

E. There shall be absolutely no unused strands of nylon line, fencing, packaging materials, or any other construction debris left on site after fence installation.

F. During the establishment period of the planted areas, the fence posts, line, and ribbons will need to be routinely inspected every week and all damaged areas repaired immediately as necessary. In particular, the fencing shall be maintained such that geese cannot trample the fence or walk into the planting area beneath the fence. At the conclusion of the establishment period, the temporary fence and any associated debris must be completely removed.

END OF SECTION

SECTION 327500

SOIL MIXES FOR WETLAND AREAS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work Included: This work includes but is not limited to the following:

1. Supply of component materials and soil amendments for Wetland Soil Mix as specified.

2. Preparation and blending of Soil Mix, as to meet specified requirements herein.

3. Installation, placement, spreading, and fine grading of Soil Mix, as specified herein.

4. Testing of all soil component materials, soil amendment materials, and Soil Mix, as specified herein.

1.3 RELATED SECTIONS

A. Excavation and Fill – Section 312300

B. Trenching and Backfilling – Section 312333

C. Erosion and Sedimentation Controls – Section 312500

D. Wetland Liners – Section 334713

E. Sustainability Requirements – Section 013010

F. DDC General Conditions

1.4 QUALITY ASSURANCE

A. The contractor shall use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 SUBMITTALS

A. All submittals, including the following, shall be as specified in the General Conditions.

B. Product Data: Submit manufacturer's technical information, including application instructions where relevant, for the following items:

1. Fertilizers

C. Samples - Soil Mix Components: Each 1 lb. packaged.

1. Topsoil

2. Compost

D. Samples - Blended Soil Mix: Each 1 lb. packaged.

1. Aquatic Soil Mix

E. Test Results - Soil Mix Components: Submit written reports, as specified herein, for each bulk component:

1. Topsoil

2. Sand

3. Compost

F. Test Results - Blended Soil Mix: Submit written reports, as specified herein, for each blended soil mix:

1. Aquatic Soil Mix

G. LEED Submittals Requirements

1. For all installed products and materials of this Section, complete the MATERIALS REPORTING FORM (blank copy attached at end of Section 013010 LEED Certification Requirements). Information to be supplied for this Form shall include:

   a. Cost breakdowns for the materials included in the Contractors or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post – industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material

listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

3. For products and materials in the LEED boundary, provide cut sheets with the Contractor's or subcontractors stamp, confirming that the submitted products are the products installed in the project.

4. The LEED Submittal Information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) Submittals may be used as the basis for rejecting the submitted products or assemblies.

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

1.7 TESTING

A. Contractor shall submit written test reports.

1. Testing shall be carried out by an independent testing laboratory.

2. Testing laboratory shall be approved by Engineer.

3. All testing required by this Section, or additionally required by Engineer, shall be furnished and paid for by Contractor.

4. Contractor shall be responsible for timely submittal of samples to the testing laboratory.

B. Each test shall be carried out using the categories and sieve sizes as specified herein. Failure to include any of the required criteria will be sufficient cause for rejection of the test.

C. Each test report shall include the following information:

1. Project Title

2. Name of Contractor

3. Name of material supplier

4. Testing Laboratory name, address and telephone number

5. Type of test

6. Date of Test

7. Test results, including identification of deviations from acceptable ranges.

D. Each sample shall be tested for the following (for additives Peat Moss and Composted Bark see E):

1. Mechanical analysis (soil texture analysis): Sieve method, using sieve sizes specified.

2. pH

3. Organic matter content: Percentage of oven-dry weight of soil, determined by loss on ignition of moisture-free sample, dried in accordance with the methods of the Association of Official Agricultural Chemists.

4. Analysis of soluble salts: Sodium, calcium, magnesium, sulfates, chlorides and bicarbonates, in milimhos per centimeter.

5. Analysis of minerals: Nitrogen, phosphorus, and potassium, in parts per million.

6. Analysis of heavy metals: In parts per million.

7. Corrective recommendations for nutrients and pH.

E. Each sample of Peat Moss shall be tested for the following:

1. pH

2. Organic matter content: Percentage of oven-dry weight, determined by loss on ignition of moisture-free sample, dried in accordance with the methods of the Association of Official Agricultural Chemists.

3. Ash content: Percentage of oven-dry weight.

4. Moisture absorption capacity: Percentage of oven-dry weight.

F. Each sample of Composted Bark shall be tested for the following:

1. Particle size distribution.

2. Wood content.

3. pH

4. Methyl bromide or other additives.

G. The Engineer may take and analyze at any time, such additional samples of materials as deemed necessary for verification of conformance to specification requirements. Contractor shall furnish samples for this purpose upon request and shall perform testing as requested at no additional cost to the City.

H. No component bulk material for Soil Mix shall be used or blended into a mix, until test reports have been received and approved by the Engineer. As necessary, make any and all soil mix amendments and resubmit test reports indicating amendments, until approved.

1.8 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary for work to comply with such requirements at no additional cost to the City.

B. Procure and pay for all permits and licenses required for the Work of this Section.

1.9 DELIVERY AND STORAGE

A. Conform to all governmental regulations in regard to the transportation of materials to, from, and at the job site, and secure in advance such permits as may be necessary.

B. Packaged Materials: Deliver packaged materials to the location where planting Soil Mixes are to be blended, in unopened bags or containers, each bearing the name and trademark of the producer, material composition, manufacturers' certified analysis, and the weight of the material.

1. All bags shall be protected from water and contamination with other materials.

2. Retain packages for inspection by Engineer.

3. All packaged materials shall be stored, handled and applied in strict accordance with manufacturer's instructions.

C. Stockpiles

1. Stockpiles of on-site or off-site bulk materials and Soil Mixes shall not exceed 50 cubic yards, and shall be no more than 6 feet in height to prevent anaerobic conditions within the piles.

2. All stock piled materials shall be adequately covered with tarpaulins or otherwise protected to prevent excessive water absorption and blowing by winds, until time of actual use.

1.10 MOCK UP – CELL 1

A. Cell 1 shall be constructed ahead of Cells 2-5 using the Aquatic Soil Mix.

1.11 LEED PERFORMANCE REQUIREMENTS

A. Soil materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 LEED Requirements Section.

PART 2 PRODUCTS

2.1 GENERAL

A. All Soil Mix components shall be tested and approved prior to incorporation into blended Soil Mixes.

B. Provide adequate quantities of all Soil Mix materials to attain, after compaction and natural settlement, all design finished grades.

2.2 SOIL AMENDMENT MATERIALS

A. The following materials may be used as amendments to achieve Aquatic soil mix.

B. Fertilizer: Use of fertilizer must be approved by Commissioner.

C. Limestone: Shall be granular limestone, produced from Dolomitic limestone specifically for use in planting, with a minimum of 88% of calcium and magnesium carbonates, conforming to the following requirements:

Sieve Size	**Percent Passing**
# 10	100
# 20	90 minimum
# 100	60 minimum

D. Sulfur: Lower pH if required, by use of elemental sulfur product.

1. Peat moss or copper sulfate may not be used to lower pH.

E. Compost: Shall be used to increase organic matter content of soil.

1. Shall conform to the following requirements:

a. Material shall be capable of sustaining the growth of vegetation, with no admixture of refuse or material toxic to plant growth.

b. Material shall be derived from organic wastes such as food and agriculture residues, composted cow or other animal manures, sewage sludge or other materials that meet the specified requirements.

c. Compost shall be screened, and shall be free of any stones, branches, roots or wood chips, and all debris such as plastic fragments, glass, and metal fragments.

d. Material shall be composted for a minimum of one year (12 months).

e. Acceptable manufacturers include:

1). Allgro, Inc., Liberty Lane, Hampton, NH 03842, 1-800-662- 2440

2). Milorganite

3). Sustane

f. Compost shall show conformance with the following requirements:

1). Organic content: 50% minimum

2). pH: 6.0 to 7.5

3). Carbon/nitrogen ratio: 25:1 to 35:1

4). Passing 1/2" screen: 100%

g. Heavy metal content shall not to exceed the following indicated amounts:

Allowed Concentration in parts per million	
Arsenic	1
Boron	300
Cadmium	2
Chromium	100
Copper	100
Lead	150
Mercury	0.50
Molybdenum	10
Nickel	50
Selenium	25
Zinc	400

2.3 AQUATIC SOIL MIX (SOIL MIX #3)

A. Aquatic Soil Mix shall conform to the following requirements:

1. Organic Matter: 4%-12% maximum (May use compost to achieve)

2. pH: 5.2 - 7.0

3. Soluble salts: Less than 2 milimhos per centimeter

4. Soil Textural Analysis: Wetland Soil Mix shall consist of the following percentages of sand, silt and clay to achieve a soil texture of loamy sand to sandy loam.

a. Sand (0.05 to 2 mm) 80% to 85%

b. Silt (0.002 to 0.05 mm) 0% to 20%

c. Clay (<0.002 mm) 0% to 20%

5. Minerals:

a. Nitrogen: Less than 12 ppm

b. Phosphorus: More than 7 ppm

c. Potassium: More than 150 ppm

2.4 HEAVY METALS

A. Each soil mix shall be tested for heavy metal content. The total heavy metal content shall not to exceed the following indicated amounts:

Element	Allowed Concentration in parts per million
Arsenic	1
Boron	300
Cadmium	2
Chromium	100
Copper	100
Lead	150
Mercury	0.50
Molybdenum	10
Nickel	50
Selenium	25
Zinc	400

PART 3 EXECUTION

3.1 INSPECTION AND COORDINATION

A. Contractor shall inspect the site before bidding to determine the characteristics of the site and the existing soil in areas to be planted.

1. Prior to construction and soil mix placement operations, the Contractor shall ascertain the location of all existing and proposed electric cables, conduits,

irrigation, under-drainage systems and all other underground or at grade utilities, by contacting the appropriate utility company.

2. Contractor shall take proper precautions so as not to disturb or damage any sub-surface elements.

3. Contractor shall be liable for and all damage to such utilities during the course of construction, and shall be responsible for making requisite repairs to damaged utilities at Contractor's own expense.

B. Contractor shall be liable for any and all damage to surrounding areas caused by planting operations and shall be required to restore or replace damage areas to original conditions, to the satisfaction of the Engineer.

C. Coordination: The Landscape Contractor shall coordinate, adjust, and relate together, work of this Section with other work of the Project and with work of other Contractors. Such coordination shall include but not be limited to:

1. Location of all underground utility lines and structures

2. Scheduling of planting operations

3. Scheduling of maintenance operations

D. Verify that all work requiring access through or adjacent to areas where soil mixes are to be placed has been completed and no further access (other than Landscape installation) will be required. In the event that access will be required, this must be coordinated with the Engineer.

3.2 WEATHER LIMITATIONS

A. Perform both blending and site soil work only during suitable weather conditions. Do not handle, haul, place, work, disc or rototill soil when frozen, excessively wet, or in otherwise unsatisfactory condition.

3.3 PREPARATION OF SOIL MIXES

A. Uniformly blend all ingredients required to achieve requirements for Wetland Soil Mix, by wind rowing and/or tilling on a hard surfaced area.

1. The components of all soil mixes shall be blended so that ingredients are thoroughly incorporated into the mixture to assure uniform distribution.

2. Do not over-mix, mix shall remain friable and well aerated.

3. Organic matter shall be maintained moist, not wet, during blending.

4. Delay mixing of fertilizers if planting will not follow within a few days.

3.4 PREPARATION OF SUB-GRADE

A. Verify as-constructed or existing sub-grade elevation and perform additional grading operations as necessary to bring the sub-grade to a true, smooth, slope parallel to the finished grade, at all areas to receive soil mixes.

B. Any sub-grades or soils polluted by gasoline, oil, plaster, construction debris, unacceptable soils, or other substances which would render material unsuitable for plant growth, shall be removed from the premises whether or not such pollution occurred or existed prior to or during the Contract period. In the event that such material is placed, this material shall be removed and replaced with approved material. All remedial operations associated with soil mixes shall be reviewed and approved by the Engineer.

C. Clean sub-grade and dispose of all debris prior to placement of soil mixes.

1. Remove all large clods, lumps, brush, roots, stumps, litter, trash, and other foreign material and stones one-half inch in diameter or larger.

2. Dispose of removed material legally off-site.

D. Spray all vegetation on sub-grade with a pre-emergent weed killer at the rate of application recommended by the manufacturer.

E. Wetland Liner must be installed on existing sub-grade prior to installation of Wetland Soil Mix where applicable.

F. Protect adjacent pavements, walls, utilities and other construction from damage or staining by any soil mix placement operations.

3.5 PLACEMENT OF PLANTING SOIL MIXES

A. Do not place any muddy or wet Soil Mixes.

B. Place and spread Soil Mix over Wetland Liner or sub-grade as shown on plan, to a depth sufficiently greater than the depth required for planting areas so that after settlement the completed work will conform to the lines, grades, and elevations shown or otherwise indicated.

C. Place and spread Soil Mix over the approved Wetland Liner or sub-grade, in 6- inch lifts, or as directed by Engineer or and settle to eliminate air pockets and minimize settlement. Lightly scarify previously placed surfaces prior to placing subsequent lifts.

D. Compact to not less than 90% Modified Proctor.

1. Provide compaction testing to conform compliance to specified compaction density.

2. Fills shall not be so compacted as to restrict the flow of air or water through the soil.

E. After completion of compaction operations, protect the installation from contamination by toxic materials or trash, and from water containing cement, clay, silt or any other materials.

3.6 GRADING OF SOIL MIXES

A. After settlement has occurred, add soil to maintain finished grades. If for any reason soil is left exposed for a long duration prior to planting, add soil and regrade as required.

B. Protect placed Soil Mix against construction activity with snow fencing or by other acceptable methods.

1. Protect from the eroding effects of wind and rain with filter fabric, as necessary.

3.7 CLEAN UP

A. At the end of each work day the Contractor shall broom-clean the site, to remove all trash, debris, and loose soil materials.

B. Immediately following the completion of soil mix installation operations, the Contractor shall remove all excess materials, stock piles, waste material, tools and equipment, and leave the site in a clear and clean condition.

C. All waste materials shall become the property of the Contractor, who shall legally dispose of same off-site.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 328000

IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Automatic irrigation system with electric/manual control including piping, fittings and accessories.
2. Temporary city water supply, backflow preventer, booster pump and all controls
3. Temporary Irrigation for Cells and North Woodland
4. High Density Polyethylene pipe (HDPE).
5. Rain Sensor with related wiring.
6. Controller (green roof) with related 24V wiring and conduit, electrical wiring.
7. Weather Station
8. Air release valve assemblies
9. Testing and instruction.
10. Excavating and backfilling for irrigation system work.
11. GPS As-Built drawings.
12. M&O Training and Demonstration.
13. Operation Maintenance Manual.
14. Warranty

B. Water for the irrigation system to be supplied from the cell structure (installed as work of other section(s)). The irrigation Contractor to install the irrigation system from this point of connection (P.O.C.) as shown on the drawings.

C. Irrigation system requirements: 750 gpm at 120 psi (dynamic) at the irrigation system point of connection.

D. The extent of the irrigation system is shown on the Drawings.

1.3 RELATED SECTIONS

A. ELECTRICAL Division 26

B. PLUMBING Division 22

C. IRRIGATION PUMP STATION Section 328001

D. MANUAL IRRIGATION SCHEDULE Section 328002

1.4 REFERENCES

A. Standards and Codes that apply to the Work of this Section:

1. RE NEC — National Electric Code, current edition.
2. UPC — Uniform Plumbing Code, current edition.
3. ASTM — ASTM International:

a. B 3 — Specification for Soft or Annealed Copper Wire.
b. D 698 — Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
c. D 1557 — Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
d. D 1784 — Specification for Rigid PVC Compounds and CPVC Compounds.
e. D 1785 — Specification for PVC Plastic Pipe, Schedules 40.
f. D 2287 — Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
g. D 2241 — Specification for PVC Pressure-Rated Pipe (SDR Series).
h. D 2464 — Specification for Threaded PVC Plastic Pipe Fittings, Schedule 80.
i. D 2466 — Specification for PVC Plastic Pipe Fittings, Schedule 40.
j. D 2564 — Specification for Solvent Cements for PVC Plastic Piping Systems.
k. D 2672 —F 690 — Practice for Underground Installation of Thermoplastic Pressure Piping Irrigation Systems.

4. ANSI — American National Standards Institute: NSF 14— Plastics Piping Components and Related Materials.

1.5 DEFINITIONS

A. The following are industry abbreviations for irrigation materials.

1. Excessive Compaction: Planting area soil or soil mix compaction greater than 75 percent of maximum dry density as determined by ASTM D 1557.
2. PVC: Polyvinyl Chloride.
3. HDPE: High Density Polyethylene
4. SDR: Standard Dimensional Ratio.
5. AWG: American Wire Gauge.

1.6 TEMPORARY IRRIGATION EQUIPMENT

A. During construction a temporary water supply and control system will be required to meet the requirements of the project. The Irrigation system will be controlled

independently from the DEP (North Area), Driving Range and the Golf Course. Provide a temporary city water connection, backflow preventer, booster pump, electrical, piping and irrigation control systems in order to irrigate the site.

1.7 SUBMITTALS

A. Shop Drawings: Shop drawings showing all piping, conduit, and irrigation equipment (ie. flow sensor, master valve, controller) for point of connection for submitted irrigation control system.

1. Include shop drawing for temporary irrigation system in Cells and North Woodland Area.

B. Product Data: Manufacturer or suppliers descriptive literature including installation instructions, for each specified product.

C. Qualifications: Experienced Contractors are required who are thoroughly trained and experienced in the skills required to install site irrigation, and who will have a qualified superintendent present, at all times, during the installation. Contractors' experience in the installation of site irrigation as outline in Submittals Section 1.7, E and F must be regularly engaged in and which maintains a regular work force in the installation of site irrigation.

D. Materials, equipment, and methods of installation will comply with the applicable requirements of the authorities having jurisdiction including the following codes and standards:

1. City of New York/State of New York Building Codes
2. National Fire Protection Association, (NFPA): National Electrical Code.
3. American Society for Testing and Materials, (ASTM).
4. National Sanitation Foundation, (NSF).
5. American Society of Agricultural Engineers, (ASAE).

E. Credentials: Name and qualifications of the irrigation contractor including comparable projects of similar work and scope that the Contractor has completed within the last three (3) years.

F. Certifications: Written certification from each product manufacturer or supplier stating that their product conforms to the specified requirements and that all products do not contain hazardous materials.

G. Samples: When requested by the City of New York submit each irrigation system component and other item(s) related to the work to confirm product characteristics.

H. Operation & Maintenance Manual: The Contractor shall furnish four (4) copies of the O & M Manual (Operation & Maintenance Manual) for the irrigation system and the associated mechanical system. The manual shall include a checklist for trouble shooting and corrective measures in addition to operation and maintenance instructions.

I. Guarantee: provide one year installer's guarantee.

J. GPS Construction Record (As-Built) Drawing:

1. Prepare "Construction Record Drawings" for irrigation system using GPS collected data and AutoCAD, release 2010 software and drawn at a scale of 1"=20'-0". Legibly mark drawings to record actual construction.

2. GPS Construction Record Drawings to consist of the following:

   a. Controller.
   b. Spray Heads.
   c. Quick Coupling Valves.
   d. Isolation Valves.
   e. Automatic Valve Assemblies with decoder number.
   f. Irrigation system mainline and lateral pipe. Routing to have size indicated.
   g. Irrigation system 2-wire path routing.

3. Maintain GPS Data of the irrigation system during the duration of the installation keeping the same current on a daily basis. GPS Data will be updated as irrigation work proceeds indicating the exact field location of all sprinkler heads, piping, valves, wire and miscellaneous equipment for the entire irrigation system. The GPS Data to be kept on-site and be available for review by the Commissioner and City of New York.

4. Submit a CD-ROM disk with digital AutoCAD drawing file(s), one (1) set of PDF files suitable for reproduction of the "Construction Record Drawings" showing actual construction.

5. Submit "Construction Record Drawings" prior to final review and acceptance.

K. Controller Drawings.

1. Controller drawings to be a reproduction of the construction record drawing reduced and printed on 8 ½" x 11" 24lb bond paper. Drawings are to be legible. If necessary use multiple sheets of 8 ½" x 11" paper and place drawings back to back.

2. Drawings are to show all irrigation zones highlighted in a different color solid hatch pattern with the designated valve schedule.

3. Seal controller drawings in 10 mil plastic laminate. When multiple drawings are required punch a hole in the upper left had corner of the laminate and connect with round key chain loop.

4. Submit two (2) drawings for each controller.

L. Irrigation Schedule.

1. Using data obtained from the water audit the Certified Landscape Irrigation Auditor shall create a typewritten schedule on 8 ½" x 11" white paper listing each

valve number, type of sprinkler (rotor, spray), description of that zone, days to water and daily runtimes for each irrigation month. Irrigation run times based on historical evapotranspiration and rainfall data.

2. Example:

Zone	Type	Days	Description	April	May	June	Jul	Aug	Sept	Oct
1	Rotor	MWF	Front Bed	15:00	17:00	25:00	25:00	30:00	18:00	8:00
2	Spray	MWF	Rear Lawn	5:00	6:00	8:00	12:00	13:00	9:00	6:00

3. Schedule to include the following note: Irrigation runtimes are based on Historical data and should be used only as a guide. All irrigation runtimes should be adjusted accordingly based on actual climatic conditions.

4. Seal irrigation schedule in 10 mil plastic laminate.

5. Submit two (2) irrigation schedules for each controller.

6. Submit all product warranties to City of New York.

1.8 COORDINATION

A. Thoroughly coordinate and schedule the work of this Section with all trades involved to prevent interferences, and in order to allow adequate time at the proper stage of construction to properly perform all work of this Section.

B. Before any work is started, a site conference shall be held between the Contractor, the Irrigation Sub/Contractor and Commissioner concerning the work to be performed under this Setion. The Landscape Plans shall be reviewed at this conference and siting, layout, hand and/or pneumatic excavation shall be discussed. Contractor shall schedule conference at the convenience of the City of NY.

C. Subcontractor to coordinate location of all piping and sleeves to be installed under walkways and driveway pavements with the Contractor.

1.9 QUALITY ASSURANCE

A. It is the intent of these Specifications and the Contract Drawings to provide for a complete installation. Therefore, any items not specifically noted but, reasonably necessary for a complete installation, to be furnished. The system is to efficiently and uniformly irrigate all areas and perform as required by the Contract Documents. The irrigation system is to be fully automatic with an electric/manual control.

B. The Contractor shall obtain all necessary permits and pay all required fees, at no additional cost to the City, to any governmental agency having jurisdiction over the work. The contractor as required shall arrange inspections required by local ordinances during the course of construction.

C. Licenses:

1. A Licensed Plumber shall make all plumbing connections. A Licensed Electrician shall perform connections to 120V power supplies.

D. Rejection:

1. The Commissioner reserves the right to reject any proposed design layout, material, or work, which does not conform to the Contract Documents. Rejected work shall be removed or corrected at the Contractor's expense immediately upon notification by the City of NY.

1.10 FINAL REVIEW AND ACCEPTANCE

A. When all irrigation work is completed and the "Construction Record Drawing" has been submitted a final review of the irrigation system will be made by the City of New York, upon written notice requesting such a review. Submit the written notice at least ten (10) days prior to the anticipated review.

B. Upon final review and acceptance, the City of New York will notify the Contractor, in writing, as to final acceptance of the irrigation system. Date of the final acceptance by the City of New York is the date beginning the warranty period.

C. Any irrigation equipment item required under this contract that is malfunctioning or in need of repair is to be removed and replaced. All replacements are to be of equipment and/or material originally specified. The cost of replacement is to be borne by the Contractor.

D. Upon acceptance of the entire system, instruct the City of New York's personnel in the complete operation of the entire system.

1.11 GUARANTEE

A. Guarantee the entire irrigation system and all related equipment and accessories for a period of one (1) year from the date of substantial completion.

B. The guarantee period will commence upon substantial completion for a complete system and/or any portion thereof has been put into operation and acceptable to the City of New York.

1.12 GUARANTEE SERVICE

A. Irrigation system shall be guaranteed for a period of 12 months after the date of Substantial Competition. During the 12 month guarantee period, the Contractor shall maintain the irrigation system

B. During the warranty period, maintain the irrigation system to ensure complete operation of the entire system. Adjust and repair all settled piping, trenches and sprinkler heads. Correct all defective or damaged work as soon as possible.

C. Return to the site during the subsequent fall season(s) (before October 30th) and winterize the entire system. Drain all water from the system via compressed air and demonstrate to the City of New York the proper procedures for the system winterization.

D. Return to the site during the subsequent spring season(s) (before April 15th) and start-up the system. Demonstrate to the City of New York the proper procedures for the system start-up, operation, and maintenance.

E. System maintenance to begin immediately upon substantial completion. Provide continuing maintenance of the irrigation system, as necessary, throughout the installation of the irrigation system.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Deliver the irrigation system components in the manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.

C. Handle materials to prevent damage.

D. Store materials to protect from sunlight, temperature variation and weather.

E. Provide secure, locked storage for valves, sprinkler heads, and similar components that can not be immediately replaced, to prevent installation delays.

PART 2 - PRODUCTS

2.1 IRRIGATION MANUFACTURERS

A. Toro Company, Riverside, California

2.2 MATERIALS

A. All irrigation equipment is to be provided by an authorized distributor.

B. All material and equipment furnished by the Contractor to be new, of the kind and type specified, of good quality, and to be delivered to the site in good condition. All materials to be protected by the Contractor until incorporated in the work and finally accepted by the City of New York.

C. Temporary irrigation equipment

1. Backflow Preventer:

a. Backflow preventer to be 6" model 825YD as manufactured by Wilkins, Watts, Febco or approved equal.

D. Controller

1. The Control System shall consist of 200 Station 2-wire controller, model DEC-SA-200 as manufactured by The Toro Company.

2. The Control System shall include a maintenance remote radio system, model TMR-1-KIT as manufactured by The Toro Company.

3. Include at no additional cost to the City of New York a site survey for the controller which shall be performed (PRIOR TO ORDERING CONTROLLER) by the Authorized Representative of the controller manufacturer to confirm radio reception.

4. Include at no additional cost to the City of New York provide account set-up and communication activation for the irrigation controller.

5. Include at no additional cost to the City of New York (3) three instructional meetings with the City of New York and Department of Parks and Recreation designated personnel and the Authorized Representative of Manufacturer. These meetings are to occur upon completion of the irrigation system installation.

E. Weather Station:

1. Weather station to be model T Weather 106 as manufactured by The Toro Company.

F. Line Decoders:

1. Line decoder shall be a fully programmable, direct bury decoder that provides an interface between the Toro controller and automatic valve. Approved line decoders shall be DEC-ISP-1 DEC-ISP-2 or DEC-ISP-4 as manufactured by The Toro Company.

G. Flow Sensor:

1. Flow Sensor shall be a 1" nylon impeller style sensor module in a brass fitting that provides current flow status. Approved Flow Sensor model shall be Rain Master FSB-100, Rain Bird model FS-100B, Badger IR250B-1.0, or approved equal.

H. 2-Wire Decoder Wire:

1. 2-Wire decoder wire to be double jacketed two (2) conductor #14 awg cable specially designed for use with the 2-wire control systems, suitable for direct burial. The conductors to be 12 -18 gauge, tin coated, soft drawn, annealed, solid copper conforming to ASTM 33 with 4/64" thick PVC (polyvinyl chloride) insulation, conforming to UL Standard #493 for thermoplastic-insulated style UF (Underground Feeder), rated at 60 degree C. Wire to be manufactured by Paige Electric, Baron or Regency Wire or approved equal.

I. Pump Communication Wire:

1. Pump Communication Wire to be shielded and armored with double jacketed two (2) conductor #16 awg cable specially designed to transmit and receive signals between irrigation satellites, central computers, weather stations, and sensors, suitable for direct burial. The conductors to be 16 gauge, tin coated, soft drawn, annealed, solid copper conforming to ASTM B-3 and B-8 with 4/64" thick PVC (polyvinyl chloride) insulation, conforming to UL Standard #493 for thermo-plastic-insulated style UF (Underground Feeder), rated at 60 degree C. The cable utilizes stranded insulated conductors, aluminum shield and drain wire to minimize electrical, magnetic, and radio frequency interference. The cable also features stainless steel tape armor for protection against rodents and for shielding of lightning and power surges. Wire to be manufactured by Paige Electric, Baron or Regency Wire or approved equal.

J. 24V Electrical Equipment:

1. Low voltage (24 VAC) wire-splice kits to be UL listed 3M DBY-6, Paige DBM or Connector Kings Dryconn or approved equal.

2. Wire connectors to be Insulated Connector (Y, R, G, B), or approved equal - size in accordance to wire AWG used.

3. Conduit for 2-wire path to be rigid 1" Non-Metalic conduit and fittings conforming to NEMA TC-2, Federal specification WC1094A and UL 651 specifications. Fittings are manufactured to NEMA TC-3, Federal specification WC1094A and UL514B.

K. Grounding:

1. Ground rods to be 5/8" by 8' copper clad steel rods.

2. Grounding plates for grounding controllers to be 4" x 8' x 0.0625" (101.6 mm x 2.44 m x 1.6 mm). A 25-foot (7.62 m) continuous length of 6 AWG, green insulated, with extruded yellow stripe, solid bare copper wire is welded to the plate. Grounding plate to be Paige Electric model #182199IC, Regency, Baron or approved equal.

3. Grounding plates for grounding decoders and 2-Wire/2-Core circuits to be 4" x 3' x 0.0625" (101.6 mm x 2.44 m x 0.9 mm). A 10-foot (3.05 m) continuous length of 10 AWG, green insulated, with extruded yellow stripe, solid bare copper wire is welded to the plate. Grounding plate to be Paige Electric model #182201IC, Regency, Baron or approved equal..

4. Earth grounding wire to be 6/1 AWG, green insulated, solid bare copper wire. Paige Electric model #150854, Regency, Baron or approved equal.

5. All grounding connectors to be of the Cadweld "One Shot" fuse type – Model GR1161GPLUS (Paige Electric model #1820037P) and Model GT1161GPLUS (Paige Electric model #1820039P). Connections to be made utilizing the Cadweld Battery Control Unit, Paige Electric model # PLUSCU, Regency, Baron or approved equal. .

6. Earth contact material for each grounding plate to be two (2) 50lb bags of "PowerSet" for loose soils, Paige Electric model #1820058 or "PowerFill" for clay soils, Paige Electric model #1820059 Regency, Baron, or approved equal..

L. Sleeves:

1. Sleeves to house pipe and wire conduit under pavement or walkways to be Sch. 40 PVC pipe w/solvent weld coupling as manufactured by JM Eagle, Ipex or Diamond Pipe or approved equal.

M. Pipe:

1. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (NSF) approval.

2. All mainline and lateral piping shall be homogenous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents.

3. Main line piping to be SDR-11 160 PSI (Butt Fusion) High Density Polyethylene (HDPE). The pipe shall be PE3408/PE3608 high density, high molecular weight resin. The pipe shall be in compliance with ASTM F714 dimension and pressure ratings. Primary properties- Cell classification shall be in accordance with ASTM D 3350-84 and 345434C/E. Pipe to be manufactured by JM Eagle, Phillips Driscopipe Inc. or ISCO Industries or approved equal.

4. Lateral piping (1 1/2" and smaller) to be POLY (polyethylene) PE 3408/3608 SIDR-15 - 100 psi NSF pipe conforming to ASTM-2239. Pipe to be as manufactured by Oil Creek Plastics, Inc., Centenial Plastics or Charter Plastics or approved equal.

N. Pipe Fittings:

1. HDPE main line BUTT Fusion pipe fittings to be SDR-11 200 PSI (Butt Fusion) High Density Polyethylene (HDPE) Driscopipe 8600 extruded from Marlex M-8000. The fittings shall be PE 4710 high density, high molecular weight. The fittings shall be in compliance with ASTM F714 dimension and pressure ratings. Primary properties- Cell classification shall be in accordance with ASTM D 3350-84 and 345434C. Fabricated fittings are to be manufactured using Data Logger to record temperature, fusion pressure, and a graphic representation of the fusion cycle shall be of the Quality Control records. Fittings to be manufactured by JM Eagle, Phillips Driscopipe Inc. or ISCO Industries or approved equal. .

2. Electrofusion Fittings for HDPE pipe – Fittings shall be made from resin or pipe meeting ASTM D 3350 with a minimum cell classification of 345434C/E. Electrofusion Fittings shall meet the manufacturing standard of ASTM F714. Fittings shall have the same pressure rating as the pipe or higher unless otherwise specified on the plans.

3. Mainline Flanged and Mechanical Joint Adapters – Flanged and Mechanical Joint Adapters shall be made from materials containing resin that meets ASTM D 3350 with a minimum cell classification of 345434C/E

4. Fittings to be used with polyethylene pipe in the landscape areas to be PVC insert fittings as manufactured by Spears, Lasco, Colonial Engineering or approved equal. Clamps to be stainless steel, worm gear hose clamps with stainless steel screws, series 6800 as manufactured by Ideal or stainless steel "ear" type clamps, series 210 as manufactured by Oetiker, SAE type "J" as manufactured by Murray Corporation or series 61 as manufactured by Ideal or approved equal.

5. PVC fittings, where required on lateral pipe, to be PVC Schedule 40. Male adapters to be PVC Schedule 80. All PVC nipples to be Schedule 80 with molded threads. Close nipples to not be allowed. Fittings and nipples to be as manufactured by Spears Manufacturing, Dura or Lasco or approved equal..

O. Dielectric Fittings:

1. ASTM F 441/F 441M, Schedule 80, CPVC threaded pipe nipples, 4 inch length.

P. Spray Heads:

1. 6" pop-up spray head to be Toro 570Z-6P-PR-COM, Rain Bird model 1806-SAM-PRS or Hunter model PRS40-06-CV or approved equal.

2. Plastic rotary nozzles to be Precision Rotary Series by Toro, MP Rotator series 1000, 2000 and 3000 as manufactured by Hunter Industries, RN Series by Rain Bird or approved equal.

Q. Swing Joints:

1. Swing joint used for pop-up spray heads to be made from Toro Funny Pipe model 850-25 and Funny Pipe elbows models 850-31 (1/2") and 850-32 (3/4") or model SJ-512 (1/2"), SJ-712 (3/4") as manufactured by Hunter Industries, Rainbird models SA-125050 (1/2"), SA-125575 (3/4") or approved equal.

2. Swing joint used for quick coupling valves to be PVC snap-loc with brass MIPT, model G13S-212 as manufactured by Lasco, Dura or Fittings, Inc. or approved equal.

R. Valves:

1. Valves on the pressure side of the automatic valves to be bronze body manual ball valves with stainless steel plastic covered handle (150 p.s.i. rated) with NPT connections. Size to be the same as the automatic valve it serves. Valves to be as manufactured by Apollo Ball Valve, Nibco or Watts or approved equal.

2. All main line gate valves to be resilient wedge type conforming to the requirements of AWWA Spec. C509. They are to have flanged connections, turn counter-clockwise to open, to be designed for 200 psi working pressure and have a 2" operating nut. Valves to be Clow Valve Company, Kennedy or Waterous or approved equal. Supply two (2) - 5 ft. main line valve keys.

3. Quick-coupling valves to be two piece bronze bodies, double slot, 1" IPS with lock top. Supply four (4) keys. Valves to be model #100-2SLVLC as manufactured by The Toro Company, model #44LRC as manufactured by Rain Bird or model #HQ-44LRC as manufactured by Hunter or approved equal. Coupler to be model #100-SLK as manufactured by The Toro Company, model #44-K as manufactured by Rain Bird or model HK-44 as manufactured by Hunter or approved equal. Supply six (6) couplers and keys. Brass hose swivels to be 1" X 3/4" model #075-MHS as manufactured by The Toro Company, model #SH-1 as manufactured by Rain Bird or model HS1 as manufactured by Hunter or approved equal. Supply six (6) swivels.

4. Automatic valves to be plastic globe type, normally closed, electric solenoid-actuated and diaphragm-operated with flow stem. Solenoid to be epoxy impregnated 24 VAC-60 Hz (18 to 30 VAC), 5.8 VA and to be suitable for direct burial. Valves to be capable of manual operation by means of an internal bleed. Sizes to be as noted on the drawings. Valves to be Toro P220 series valves, Rain Bird PEB series or Hunter ICV series valves or approved equal.

5. Master valve to be brass globe type, normally open, electric solenoid-actuated and diaphragm-operated with flow stem. Solenoid to be epoxy impregnated 24 VAC-60Hz (18 to 30 VAC), 5.8 VA and to be suitable for direct burial. Valves to be capable of manual operation by means of an internal bleed. Valve to be series 3100 as manufactured by SuperiorBuckner Controls Company, 400 series Bermad Inc, 2000 series Griswold or approved equal.

6. Flush hydrant to be model Aquarius #108-2". Supply one (1) 2-1/2" x 50' fire hose with proper connections and Sch. 80 PVC riser, see detail drawings. Depth of flush valve will determine length of 2" riser pipe. Flush hydrant to be as manufactured by Gil Industries, Inc., Tru-Flow, Zurn, or approved equal.

7. Pressure Reducing Valve to be 3" model N223F super capacity water pressure reducing valve as manufactured by Watts, Wilkins or Febco or approved equal. .

8. Valve identification tags to be standard size, model ID-STD-Y1. The identification tag shall be stamped with the following designation L1, L2 etc. for lawn areas, P1, P2 etc. for planter areas and T1, T2 etc. for tree pit areas to match number of valves per controller. The identification tags to be manufactured by T. Christy Enterprises, Seton, BradyID or approved equal.

S. Valve Boxes:

1. Valve boxes used with automatic valve assemblies (other than drip irrigation) to be 12" x 17" x 12" deep valve boxes; black in color. Valve boxes to be model #1419-12" with L-Bolt down option Black T-cover as manufactured by Carson Industries LLC, model #174541 as manufactured by Pentek or VB-STD-H as manufactured by Rainbird or approved equal.

2. Valve boxes used with 1" drip irrigation valve assemblies to be 15" x 21" x 12" deep valve boxes; Black in color. Valve boxes to be model #1220-12" with L-Bolt down option BLACK T-cover as manufactured by Carson Industries LLC,

model #190156 box with #194006 cover with snap locks as manufactured by Pentek or model VB-JMB-H as manufactured by Rainbird or approved equal.

3. Valve boxes for drip irrigation flush valves, ground rods and quick coupling valves to be 6" round valve box. BLACK in color. Valve boxes to be model #L-0708 as manufactured by Carson Industries, model #182103 with snap down BLACK cover as manufactured by Armor Access Boxes, VB-7RNDK as manufactured by Rainbird or approved equal.

4. Valve box extensions, as required, to be of the same size, color and manufacturer as the box on which it is used.

T. Rain Sensor:

1. Wireless rain sensor to be model 53770 as manufactured by The Toro Company, WR2-RS as manufactured by Rain Bird or model WR-CLIK as manufactured by Hunter Industries or approved equal.

U. Pressure Gauges:

1. Pressure gauges to be (0-200 PSI) 2" x 1/4"-NPT, model 1005S stainless steel as manufactured by Ashcroft, Cole-Parmer, Omega or approved equal.

2.3 ACCESSORY MATERIALS

A. Drainage Stone for Valve Boxes:

1. One-half inch (½") to three-quarter (3/4") size, washed, graded crushed stone.

B. Fabric:

1. Soil separation fabric at valve boxes shall be Mirafi 140N, StrataTex ST142, US Fabrics US 120NW, non-woven, spun bound, polyester geotextile fabric or approved equal.

C. Brick:

1. Common, grade SW, per ASTM C42.

D. Reinforcing Rods:

1. Steel, galvanized.

E. Bedding for Piping Material:

1. Coarse, mason sand conforming to ASTM C-33.

F. Trench Backfill in Lawn and Planting Areas:

1. Refer to Section 312000, Earthwork.

G. Suitable excavated materials removed to accommodate the irrigation system work are to be used as fill materials provided it conforms to the requirements of fill as noted above.

1. Soils on site are to consist of sub grade materials and planting soil mix. Materials placed at different levels and thicknesses depending upon planting types and locations. Separation of materials to be maintained.

H. PVC Cement/Primer

1. PVC cement to be IPS - #721, #725 Wet "R" Dry, Recto-Seal Gold or approved equal. PVC primer to be IPS - #P-70 (purple), Oatey Industrial Grade (Purple), Spears Primer-70 (Purple) or approved equal. PVC cement for Schedule 80 nipples to be IPS #711, #725 Wet "R" Dry, Recto-Seal Gold or approved equal.

I. Thread Sealant:

1. Assemble brass to brass threaded fitting connections with non-hardening thread sealant- Lasco Blue Pipe Thread Sealant, Permatex #80045, Rectorseal Tru-Blue sealant or approved equal.

2.4 Extra Materials:

A. The following materials to be left with the City of New York, prior to completion of the work to be utilized in repair and maintenance.

1. 300' - 1 ½" Poly PE #2306 100 psi pipe
2. 500' – 1" Poly PE #2306 100 psi pipe
3. 400' – Blank drip tubing
4. 100 – Stakes
5. 6 – 6" pop up sprinklers with swing joints
6. 2 - 1" automatic valves
7. 6 - 1" quick coupling valves
8. 8 - Standard valve boxes w/cover
9. 4 - 24 - 24 VAC wire splice kits
10. 6 - Single decoders

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions where Site Irrigation is to be installed. Notify the City of New York, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the City of New York.

3.2 PREPARATION AND LAYOUT

A. The location of sprinkler heads, valves and piping, noted on the drawings, are generally diagrammatic to the extent that swing joints, off sets and all pipe fittings are not shown; exact locations of piping, sprinkler heads, valves, and other components are to be approved by the City of New York in the field prior to the time of installation.

B. Pipe routing is to be in accordance with the drawings, however, the City of New York shall have the right to change the route and/or depth of the pipe from that shown in cases where rock or other obstacles may interfere with the intended path or depth of the piping.

C. Stake all proposed pipe and wire routes, sprinkler, valve and controller locations in accordance with the locations noted on the drawings; provide staking prior to the commencement of work in any area of installation; furnish all supplies, equipment and personnel necessary for the staking of the work.

D. Notify the Commissioner a minimum of five (5) days prior to the scheduled staking.

E. Coordinate the irrigation work with planting and lawn work as to have irrigation available at time of the turf and plant material establishment.

F. Coordinate irrigation work with plumbing, electrical and sleeve work.

G. Final system layout to be acceptable to the City of New York.

H. Contractor to install temporary water connection at South 8" double check meter pit for Package 4 area establishment irrigation systems. Contractor to coordinate temporary irrigation piping, and is responsible for all temporary system components listed and not limited to the following:

1. Temporary Controller and 2-wire path installed at permanent South 8" double check meter pit with associated grounding and electrical connections.

2. Temporary Pump at permanent South 8" double check meter pit and associated electrical connections.

3. Irrigation line connecting to Package 4 irrigation system.

I. Contractor is responsible for coordinating transitional preparations and execution. Contractor to coordinate transition with the Commissioner.

1. At completion of the maintenance and guarantee period of DEP (North Area) and Final Approval of Commissioner, the main water lines within DEP (North Area) shall be decommissioned.

2. After decommissioning the main water lines, the contractor shall relocate and install temporary controller and 2-wire path in coordination with DPR representative at Moshulu Golf Course Pump Station at Maintenance Shed and connect the controller to DEP-DPR driving range irrigation system to form an operational system.

3.3 CUTTING AND PATCHING

A. Methods and materials used for cutting and patching to be acceptable to the Commisioner.

B. Materials and finishes for all patching to match existing cut surface materials and finish.

C. Cut through concrete and masonry with core drills. Jack hammers not permitted.

D. Seal all openings in exterior walls water tight with link seals.

3.4 CONDUIT:

A. Install all electrical conduits for 24V control wiring.

B. Backfill and thoroughly compact around all conduit.

C. All conduits to have a minimum cover of twenty four inches (24").

3.5 SLEEVES:

A. Coordinate installation of sleeves for all piping and conduit/24V control wire passing under concrete curbing, concrete or masonry walls and pathways while the same are under construction.

B. Install all sleeves for all piping and conduit passing under planter walls, curbing, concrete or masonry walls and pathways while the same are under construction.

C. Install ends of sleeves six to twelve inches (6"-12") beyond the edge of all pavement and curbs.

D. Backfill and thoroughly compact around all sleeves.

E. All sleeves to have a minimum cover of twenty four inches (24").

F. All sleeve locations to be staked or permanently marked.

3.6 INSTALLATION

A. Temporary Irrigation Equipment

1. Install water connection, backflow preventer, booster pump (125 gpm at 75 psi boost) with power supply (3ph 208V) on concrete pad including, but not limited to all piping, fittings, excavation, thrustblocking, backfilling, manpower required.

B. Winterization Assembly:

1. Install winterization assemblies as detailed on the drawings.

C. Main Line Isolation Valve(s):

1. Install main line Isolation valves as detailed on the drawings.

D. Master Valve:

1. Install master valve on mainline and connect to the master valve terminal of the irrigation controller. See detail drawings.

E. Flow Sensor:

1. Install flow sensor on mainline and connect to the sensor terminal of the irrigation controller. See detail drawings.

F. Excavating and Backfilling:

1. Provide all excavation, backfilling and compaction required for the proper installation of all piping.

2. All piping is to be trenched. Pipe pulling method is not to be used.

3. Excavation is to include all materials encountered.

4. Minimum trench width is to be three inches (3") on each side of the main line pipe and one and one half inches (1½") on each side of lateral pipe to allow for proper compaction of backfill material.

5. Minimum depth of cover:

   a. Main line piping: - 24" of cover.
   b. Lateral piping: - 14" of cover.
   c. Control wire: - 24" of cover.
   d. Control wire and pipe under pavement: - 24" of cover.

6. Excavate to the depths required to allow a four inch (4") depth of sand bedding material for piping where pipe settles on rock, shale or where the pipe cannot be fully supported along its entire length.

7. Install a four inch (4") depth of sand bedding material where pipe settles on rock, shale or where the pipe cannot be fully supported along its entire length.

8. The trench bottom should be smooth and free of rocks greater than 1 1/2" diameter, large dirt clods or any frozen material. Excavation at bells (bell holes) should be provided to allow pipe to be fully supported along its length.

9. Bed pipe to provide uniform longitudinal support under the pipe to prevent low spots.

10. Backfill material to be free from rock, large stones, large dirt clods or other unsuitable substances to prevent damage to pipe during backfilling operations.

11. Initial backfill to be properly compacted continuously above the bedding and around the pipe as well as between the pipe and undisturbed trench walls. Initial backfill is to be done by hand.

12. Backfill trenches to match adjacent grade elevations with approved trench backfill material. Place and compact fill in layers not greater than six inch (6") depth to ninety-five percent (95%) maximum dry density at optimum moisture content under all paving areas and 85% maximum under lawn and planting areas.

13. Excavate trenches; install piping and backfill during the same working day. Do not leave open trenches or partially filled trenches overnight.

G. Pipe Fusion:

1. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe supplier's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe supplier. The butt fusion joining will produce a joint with weld strength equal to or greater than the tensile strength of the pipe itself. All field welds shall be made with fusion equipment equipped with a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the Quality Control records.

2. Mechanical joining will be used where the butt fusion method cannot be used. Mechanical joining will be accomplished by either using a HDPE flange adapter with a ductile iron back-up ring.

3. Hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

H. Pipe Laying:

1. Inspect the pipe for defects before installation and fusion. Defective, damaged or unsound pipe will be rejected.

2. Pipe to be installed in accordance with ANSI/ASAE Standard #S376.1 and the printed instructions of the manufacturer, including leveling of trench bottoms and bedding of pipe in bottom trench.

3. Allow joints to set at least 24 hours before pressure is applied to the system.

4. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.

5. Join HDPE pipe using butt-fusion technique as per the written instructions of the manufacturer. Join HDPE pipe to dissimilar pipe material using HDPE (butt-fusion) x flange adapter with ductile iron back-up ring.

6. Cement all solvent weld fittings in strict accordance with cement manufacturer's printed instructions. Color primer to be used.

7. Install all wall penetrations through planter walls where required to make plumbing and/or electrical wiring connections. All penetrations to be watertight. Penetrations and seals to be acceptable to the Commissioner.

8. All insert type fittings on laterals 1 ½" or larger to be double clamped. Insert fittings used on 1 ¼" or smaller poly pipe to be single clamped.

I. Clearances:

1. Minimum horizontal clearances between pipes: 4 inches for 2 inch pipe and less; 12 inches for 2 inch pipe and more.

2. Minimum vertical clearances between pipes: Two inches.

J. Dielectric Fittings:

1. Provide dielectric fittings between copper and ferrous metal piping.

K. Spray Heads, Quick Coupling Valves, Fittings, and Accessories:

1. Spray heads and quick coupling valves to be connected to the piping system by installing factory assembled PVC swing joints. Swing joint size to be the same size as that of the IPS inlet of the sprinkler, or as otherwise shown. The long nipple of the swing joint to be set between 20 and 60 degrees from the horizontal. Install quick coupling valve in 6" econo box and set within 1" of the bottom of the box cover. See detail drawings.

2. All sprinklers and quick-coupling valves are to be set flush to finish grade.

3. Locate quick coupling valves along main line piping in a location approved by the Commissioner.

4. Install fittings, valves, sprinkler heads, risers and accessories in accordance with manufacturer's printed instructions, except as otherwise indicted or as detailed on the drawings.

5. Install all pop-up spray heads with flex pipe swing joints as shown on the drawings.

6. Obtain Commissioner's review and acceptance of height for risers, spray heads, sprinklers and quick coupling valves.

L. Valve Boxes and Valve Assemblies:

1. All valve box locations are to be staked prior to installation and approved by the Commissioner prior to starting construction.

2. Valve boxes to be installed as shown on drawings with adequate space for operation, service and removal of the equipment in the box. Refer to Details Sheet.

3. Do not group more than two irrigation valve boxes together in one location. When grouping two valve boxes together allow 12" of space between boxes.

4. Where necessary to properly fit the pipe, boxes to be neatly cut so as to provide a firm fit to the pipe. Soil or gravel not to be allowed to enter the box through these cut-outs.

5. All boxes to be mounted plum and flush to finish grade - extensions to be used as required for proper installation and setting. Surrounding grade to be established with the use of a leveling board not less than 4' in length. Box to be set to the underside of this board.

6. Do not install more than one valve assemblies per valve access box.

7. Install all valve boxes in planting beds in a location approved by the City of New York. Do not install valve boxes in lawn areas.

8. Seal threaded connections on pressure side of control valves with teflon tape.

9. Automatic valve assemblies to be as per drawings using standard brass nipples, Heavy Duty brass fittings and PVC Schedule 80 nipples.

10. Ball valves to be installed in the "closed" position and to not be opened until the main line piping system has been pressurized and flushing has been completed through the blow-out valve assembles.

11. Assemble brass to brass threaded fitting connections with non-hardening thread sealant - Lasco Blue Pipe Thread Sealant, Permatex #80045, or approved equal.

12. Assemble threaded PVC to PVC, or brass to PVC, with the use of two (2) wraps of Teflon tape.

13. Assemble threaded connections so that thread sealant or Teflon tape does not enter the pipe or fitting.

14. Automatic valve manual bleeds to not be used for continual operation. For extended use without 24 VAC, the manual bleed to be left in the open position and the flow to the zone controlled (on-off) by the manual ball valve.

15. Install valve identification tag on each valve assembly as shown on the drawings.

M. Controller:

1. Controller to be wall mounted in the mechanical room in a location approved by the Commissioner. Install the controller in accordance with manufacturer's printed instructions and connected so as to form an operational system. Diagrammatic location shown on the drawings.

2. Valve control wires to be numbered with waterproof labels corresponding to their valve number (A1, A2 etc).

N. Controller Power Supply:

1. Controller to have one circuit with full time 120VAC GFCI outlet and 120VAC to the controller with on/off switch.

2. Power to the controller to be supplied from a dedicated circuit and brought to the controller location (Installed as part of work of other section(s) and contract).

3. The irrigation Contractor to be responsible for all wiring and associated equipment to connect power supply from dedicated circuit to the controller.

4. All 120V wiring is to be done by a licensed professional.

5. All wiring is to be in accordance with all state and local codes. Refer to and comply with Electrical work requirements specified in Division 26.

O. Weather Station:

1. Weather station to be installed in a location approved by the Commissioner.

2. Install weather station on concrete pad as per the manufacturer's written instructions.

P. Grounding/Surge Protection:

1. All surge protection and grounding to be installed in strict compliance with the manufacturer's printed instructions and in accordance with local, State and Federal codes and requirements.

2. Place ground rod in a location approved by the City of New York.

3. Drive 8' ground rod to its entire length.

4. Connect 6/1 solid copper wire to the ground rod with Cadwell type weld connector. Ground wires to be installed as straight as possible from point of connection to ground rod and from rod to rod. No sharp bends or turns to be allowed.

5. Connect 6/1 solid copper wire to the surge suppression device in accordance with the manufacturer's printed instructions.

6. The ground plates are to be installed to a minimum depth of 30" (76 cm), or below the frost line if it is lower than 30".

7. Two 50-pound bags of "Earth Contact Material" must be spread so that it surrounds and the 8-foot copper plate evenly along its length within a 6" (152 mm) wide trench. Use one bag only for the installation of 3-foot ground plates. Salts, fertilizers, betonite clay, cement, coke, carbon, and other chemicals are not to be used to improve soil conductivity because these materials are corrosive and will cause the copper electrodes to erode and become less effective with time. It is important that the Earth Contact Material completely surrounds the ground plate

and 6" (152 mm) of the insulation of the green wire, as shown in the detail, in order to minimize corrosion.

8. Connect 6/1 AWG earth grounding, green insulated, solid bare copper wire to the ground rod and grounding plate with Cadweld connector. Install all grounding circuit components in straight lines and simple geometry. No sharp bends or turns to be allowed. When necessary to bend wires, make sweeping turns as detailed. All grounding and bonding wires of electronic equipment must be fed through a dedicated 1.5" (38.1 mm) plastic sweep ell. "Sweep bends" must follow the guidelines shown here. The 6/1 AWG bare copper wires are to be installed in as straight a line as possible, and if it is necessary to make a turn or a bend it shall be done in a sweeping curve with a minimum radius of 8" (203.2 mm) and a minimum included angle of 90°. This type of installation, which utilizes a multi-position bus bar, allows for rapid connecting and disconnecting of desired wires in order to periodically take earth resistance readings of the individual grounding electrodes.

9. The earth-to-ground resistance is to be measured at the time of installation using a "Megger", or other similar instrument, and the reading is to be no more than 10 Ohms. If the resistance is more than 10 ohms, additional ground plates and "Earth Contact Material" are to be installed using the 100-2002 (www.asic.org, "Design Guides".) It is required that the soil surrounding copper electrodes, within the Sphere of Influence, be kept at a minimum moisture level of 15% (by weight) at all times as dry soil does not conduct electricity. ALL GROUNDING COMPONENTS MUST BE CONNECTED TO THE EQUIPMENT BEFORE ANY OTHER CONNECTION IS MADE.

10. Surge suppression device to be installed at every line termination point. Install first surge suppression device within 100 feet of central control system. Additional installation of surge suppression devices are needed per 600 feet of wire cable, located at the nearest line decoder. The surge suppression device ground wires to be connected to a single grounding rod as detailed.

Q. Measuring Resistance

1. Earth resistance shall be measured and recorded after the installation of the grounding grid(s), and every three months thereafter for the first year. This data should be used to determine the most critical times of the year, based on soil moisture content and lightning frequency. The resistance shall be tested and recorded every six months thereafter, at these most critical dates, to ensure that proper contact with the soil is maintained at all times. Resistance measurement shall be made using commercially available instruments, in accordance with the latest requirements of NFPA 780. Follow instrument manufacturer's specific operating instructions.

2. Readings of 5 to 10 ohms are desirable. The effectiveness of the circuit is a function of its impedance, which cannot be measured in the field in a practical manner. Sound practices and proper installation are more important in assuring quality results than this reading.

3. The minimum requirements of the NEC shall be met, which are:

a. A resistance reading of no more than 25 ohms.

4. In installations with multiple equipment locations, the resistance readings of like grounding circuits should be compared for consistency. Large variances in readings point to different soil conditions, or soils with varying degrees of moisture content, or improper installation.

R. Rain Sensor:

1. Install rain sensor in a location approved by the Commissioner. Install all wire inside rigid metallic conduit.

S. Line Decoders:

1. Install on each automatic valve assembly a line decoder in accordance with manufacturer's printed instructions. See detail drawings.

2. The contractor is to be responsible for accurately recording on the as-built drawings, as each decoder is being installed, the address number of the decoder at that location. It is also necessary that it be indicated which remote controls valves controlled by each specified decoder.

T. 2-Wire Path Cable:

1. Install 2-wire path in conduit and locate in pipe trenches. Place conduit in trench adjacent to pipe. Install wire with slack to allow of thermal expansion and contraction.

2. Install control wire under pavements in PVC sleeves. Coordinate location of wiring and sleeve locations.

3. Install a thirty-six inch (36") long wire loop with expansion joint at remote control valves in control boxes to allow raising the valve bonnet to the surface without disconnecting the wires when repair is required. At all splice and valve assemblies make 5-6 turns of the wire around a piece of ½" PVC pipe to allow for thermal expansion and contraction.

4. Connect each remote control value to one line decoder and connect to two-wire path.

5. Make all two wire connections to automatic valves completely waterproof using UL listed splice kit. Install in strict accordance with the manufacturer's printed instructions.

U. Air Release Valve Assemblies:

1. Install air release valve assemblies as detailed at the highest elevation points along the main line piping of the irrigation system in a location approved by the City of New York.

2. Test air release assemblies for operation prior to acceptance of the system.

V. Flush Valve Assemblies:

1. Install flush valve assemblies as detailed on the drawings in a location approved by the Commissioner.

2. Install flush valve so that flushing water can be discharged into an area designated by the Commissioner. Flush valve assemblies to be used to flush the main line piping system during original start up and during subsequent flushing that may be required due to pipe breakage or leaks.

3.7 PRESSURE TESTING

A. Use Hydrostatic pressure test **ONLY**. Pressure test using air or compressed gas is not acceptable.

B. Approximate amount of gallons of water required to fill 100' for test of mainline pipe are noted below:

1 1/2"	13 gallons
2"	20 gallons
2 1/2"	29 gallons
3"	43 gallons
4"	70 gallons

C. Testing should be performed at the lowest elevation along the pipe to be tested.

D. Pressure testing shall be conducted in accordance with the ASTM F 2164, Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. The HDPE pipe shall be filled with water, raised to test pressure and allowed to stabilize. The test pressure shall be 1.5 times the operating pressure at the lowest point in the system. In accordance with section 9.8, the pipe shall pass if the final pressure is with 5% of the test pressure for 1 hour. For safety reasons, hydrostatic testing only will be used.

E. When main line pipe is installed in phases and/or segments pressure test each main line segment and/or phase.

F. All lateral piping to be tested under working conditions and visual inspection made for leaks.

G. All leaks to be repaired and the lines retested until approved by the City of New York.

H. Notify the Commissioner and the City of New York seventy-two (72) hours prior to testing.

3.8 FLUSHING AND ADJUSTMENT

A. After piping is installed and before sprinklers and spray heads are installed, open control valves and flush out the system with full head of water until pipe is free of all foreign materials.

B. Adjustment of the sprinkler equipment will be done upon completion of the installation, to provide optimum performance and to assure that all sprinklers are properly set to grade.

C. Adjust all automatic valves by means of the flow control stem and verify sprinkler discharge pressure on each lateral zone, with a pitot tube and gauge, to obtain optimum sprinkler performance in accordance with manufacturer's printed instructions.

D. After the system has been installed, test the entire system and demonstrate that the entire system meets coverage requirements and automatic controls function properly.

3.9 CLEAN UP AND PROTECTION

A. Upon completion of all work of this Section, remove and legally dispose of all excess materials resulting from the work operations of this Section.

B. Accumulation of materials for disposal is not permitted. Disposal is to be made as fast as materials accumulate.

C. Adequately protect all paving, surfacing, lawn areas and plant material and restore to original condition all damages resulting from work operations of this Section.

D. Contractor shall be responsible for removal of temporary equipment, not limited to temporary pump and electrical connection at South Check meter pit. Reference paragraph 3.02 for additional provision.

3.10 Maintenance & Operations Staff Instruction and Demonstration

A. After testing is completed and approved by the Commissioner, a instruction and demonstration session shall be held for the M&O staff. The installed irrigation system shall be demonstrated for one day (maximum 6 hours) for the district M & O Staff. The demonstrations shall include manual and automatic operation including pumping. The demonstration shall also include identification and operation of each component, trouble shooting for each component, winterizing the system, removal and replacement of defective components, general and specific requirements for the system maintenance, and a check list for frequent attention of components. Highlights of the demonstration, including identification of components shall be videotaped for future M&O instruction.

3.11 Operations and Maintenance Manual

A. The Contractor shall furnish four (4) copies of the O & M Manual (Operation & Maintenance Manual) for the irrigation system and the associated mechanical system. The manual shall include a checklist for trouble shooting and corrective measures in addition to operation and maintenance instructions.

END OF SECTION 328000

SECTION 328001

IRRIGATION PUMP STATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to provide a single source responsibility for the manufacture of the complete system including pumps, warranty, service and operation of a prefabricated, skid mounted fully automatic variable speed pumping system (systems). The pumping system shall automatically maintain a constant discharge pressure regardless of varying flow demands within the station rating. Pumping system shall conform to the following specifications in all respects. This specification covers the minimum requirements; however, it should not be construed as all inclusive. It is the successful manufacturer's responsibility to include all necessary components to provide for a complete, automatic, smooth operating, and reliable pumping system.

1.3 RELATED SECTIONS

A. Electrical Division 26

B. Plumbing Division 22

C. Irrigation System Section 328000

1.4 REFERENCES

A. Standards and Codes that apply to the Work of this Section:

1. RE NEC — National Electric Code, current edition.
2. UPC — Uniform Plumbing Code, current edition.

1.5 SUBMITTALS

A. The pump manufacturer shall provide the following:

1. A complete set of general arrangement drawings, including all dimensions.
2. Electrical power schematics, and control schematics
3. UL Listed as a Packaged Pumping System.

B. Materials, equipment, and methods of installation will comply with the applicable requirements of the authorities having jurisdiction including the following codes and standards:

1. City of New York/State of New York Building Codes
2. National Fire Protection Association, (NFPA): National Electrical Code.
3. American Society for Testing and Materials, (ASTM).
4. National Sanitation Foundation, (NSF).
5. American Society of Agricultural Engineers, (ASAE).

C. Manufacturer Guarantee: The pump manufacturer shall warrant the pumping station to be free of defects and product malfunctions for a period of one year from date of start up or fifteen months after shipment, whichever occurs first. Failures caused by, lighting strikes, power surges, vandalism, flooding, operator abuse, or acts of God are excluded from warranty coverage. All warranties implied or otherwise shall not exceed those warranties extended by major or sub-component suppliers.

D. Manufacturer Service Network

1. The pump manufacturer shall maintain a Factory Trained and Managed Service Network to execute all warranty claims.
2. All service entities must maintain as their primary core business the maintenance, service and repair of pump systems.
3. Authorized Service Technicians must be Factory Trained and maintain a minimum of 25 hours per year of on going in-factory training.
4. The manufacturer shall provide 24/7 technical phone support to the end user during and after the warranty period.

1.6 COORDINATION

A. Thoroughly coordinate and schedule the work of this Section with all trades involved to prevent interferences, and in order to allow adequate time at the proper stage of construction to properly perform all work of this Section.

1.7 QUALITY ASSURANCE

A. The Contractor shall obtain all necessary permits and pay all required fees, at no additional cost to the City, to any governmental agency having jurisdiction over the work. The contractor as required shall arrange inspections required by local ordinances during the course of construction.

B. Licenses:

1. A Licensed Plumber shall make all plumbing connections.
2. A Licensed Electrician shall perform connections to power supplies.

1.8 FINAL REVIEW AND ACCEPTANCE

A. When all pumping work is completed a final review of the pumping system will be made by the City of New York, upon written notice requesting such a review. Submit the written notice at least ten (10) days prior to the anticipated review.

B. Upon final review and acceptance, the City of New York will notify the Contractor, in writing, as to final acceptance of the pumping system. Date of the final acceptance by the City of New York is the date beginning the warranty period.

C. Upon acceptance of the entire system, instruct the City of New York's and Department of Parks and Recreation designated personnel in the complete operation of the entire system.

1.9 GUARANTEE

A. Warranty the entire pump system and all related equipment and accessories for a period of one (1) year from the date of substantial completion against all defects in workmanship and material.

1.10 GUARANTEE SERVICE

A. Irrigation system shall be guaranteed for a period of 12 months after the date of Substantial Competition. During the 12 month guarantee period, the Contractor shall maintain the irrigation system

B. During the warranty period, maintain the pumping system to ensure complete operation of the entire system.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The prefabricated pump station shall have a capacity of 750 GPM and a discharge pressure of 120 PSI at skid edge as described in the technical specifications. The overall pump length shall extend to within twelve inches of the bottom of the wet well. The main pumps shall operate at no more than 1800 RPM.

1. In addition, the pump station discharge shall provide a 60 gpm tap to connect to the greywater system.
2. In addition, the pump station discharge shall provide a 30 gpm tap to connect to the green roof irrigation system.
3. In addition, the pump station shall include a fertigation system.

B. The pump station controls shall communicate with Toro Lynx central and allow for the following features.

1. The pump station will provide constant pressure, flow and alarms to the Toro Lynx central on the menu bar in the Toro Lynx screen.
2. The pump station will continuously provide status information to the Toro Lynx system to allow for fault indication of any pump and provide the ability to recalculate flows based upon available pumping capacities.
3. The pump system shall be equipped with APS (automatic power saver) to allow the user to reduce the set point pressure during non irrigating hours. If selected the Toro Lynx system shall instruct the pump system to go into APS mode to a set point pressure set by the end user.
4. Prior to irrigation program cycle the pump station shall automatically start and come up to set point pressure. If the station is equipped with filtration the filters will be pre-flushed prior to the irrigation cycle.

C. The station shall be completely wired, piped, hydraulically, electrically, and flow tested to full station capacity at factory prior to shipment to job site. Documentation of dynamic test shall be verified by owner prior to pump station shipment.

D. Construction shall include a fabricated steel plate and skid assembly to support all components during shipping and to serve as the installation mounting base.

E. The discharge manifold from the pump station shall terminate at or near the pump station skid edge and be provided by the pump station manufacturer.

F. The pumping system shall be model VWTP-750-4-120 (3 pumps) as manufactured by Flowtronex PSI Inc. or approved equal. Total Design Flow 750 GPM @ 120 PSI Station Discharge.

G. The station shall be the capacity as shown in the technical data listed below:

Third Party Listing

Starting Equipment	U.L. Listed as and Industrial Control Device
Controls	U.L. Listed as and Industrial Control Assembly
VFD Controls	U.L. Listed as and Industrial Control Assembly
Pump Station	U.L. Listed as a Packaged Pumping System

Total Design Criteria

Zone	Flow (GPM)	Pressure (PSI)
1	750	120

Incoming Power

	Amps	Fault Amps	KVA	Voltage	Phase	Hertz
Service Entrance	82	60,000	65	460	3	60

Main Disconnect

	Amps	Volts
Disconnect Capacity	200	600

Variable Frequency Drive

Operating Temperature	0 to 40°C (32° -104°F)
Humidity	Non-Condensing
Minimum Efficiency	98% (full load, base speed)
Frequency Rating	100% continuous drive rating, Intermittent 111% Drive rating for one minute

Safety	Setting
Incoming Phase Failure and Low Voltage and Phase Reversal	10% +/-
Individual Power Phase Failure and Low Voltage	10% +/-
Low Discharge Pressure Shut down	25 PSI Below Setpoint
High Discharge Pressure Shutdown	15 PSI Above Setpoint
Low Water Level Shutdown	2' Above Pump Suction

	PMP	Pump #1-3
Motor HP	3	30
Motor/Pump RPM	3600	1800
Motor Service Factor	1.15	1.15
Motor Efficiency	85%	90.2%
Motor Power Factor	88	85.3
Motor Type	SUB	WP1
Motor Disconnect Volts	600	600
Motor Full Load Amps	4.8	37
Motor Fuse Amps	6	65
Motor Fuse AIC Rating	200,000	200,000
Motor O.L. Rating, Amps	4.8	37
Motor Starter Type	IEC/XL	IEC/VFD/XL
Motor De-rate For Altitude	N/A	N/A
Motor CFM Requirements	N/A	480
Total Station CFM Requirements		2900
Pump GPM	25	250
Pump TDH	312	312
Pump Efficiency at Design	65%	82.8%
Pump Shut Off Head, FT	450	395
Pump Column Pipe ID	2"	4"
Pump Discharge Size	2"	4"
Pump Check Valve Size	2"	4"

Check Valve Rating, PSI	200	200
Check Valve Drop at Capacity, PSI	3	3
Pump Isolation Valve Size	2"	6"
Isolation Valve Rating, PSI	200	200
Station Relief Valve Size	N/A	2-1/2"

All Motors to be VFD rated, Motor Starting Code G, Class F Insulation,

Station Discharge Information

Zone	Isolation Valve	Meter Run Size	Meter Type	Z Pipe	TOL's
1	6"	4"	Magnetic	N/A	3-3/4"
2 (Green Roof)	2"	2"	Magnetic	N/A	
3 (Grey Water)	2"	2"	Magnetic	N/A	

Control Valve (Green Roof, Grey Water)

Model	Size	Quantity	MFG.
92-01 (red/sust/bc) or approved equal	2"	2	Cla-Valve or approved equal

Filtration (Optional)

Manufacturer	Size	Quantity	Model	Micron
VAF or approved equal	6	1	V1000 or approved equal	300

Manufacturer shall provide a filter by-pass

Remote Interface & Alarm Notification (Optional)

Modem		Internet		Direct		Radio	X	Cellular	

Nutrifeed or approved equal Fertigation System

Model	Total GPH Per Head	Tank GPM-Quantity
NFR1-200C or approved equal	12.3	

Mixing System

GDR	Size
Model GDR300 or approved equal	300Gallons

Fertigation System Interface (Optional)

Run Relay		Optical Isolator	x

Remote Recharge System Interface (Optional)

Level Sensor Type	Quantity	Voltage
Transducer	1	120V

Site Conditions & Intake Screen (Optional)

Wet Well Depth	
Wet Well Diameter	
Intake Flume Size, Type & Length	
Reservoir Intake Screen Size*	

*Reservoir Intake Screen shall be made from all stainless steel components.

2.2 Mechanical

A. Scope. Pump station shall be a completely skid mounted vertical turbine VFD pump station built by a single manufacturer. All equipment including but not limited to pumps, motors, piping, filters, valves, instrumentation and controls (unless otherwise noted in the technical specifications or drawings) shall be mounted on a common structural base to form a complete operating pumping station.

B. Paint Structural steel, attached piping, and supports shall be grit-blasted with #50 steel grit per SSPC-10 to a near white metal condition. The cleaned steel surface shall be immediately coated with an aliphatic polyurethane coating to a thickness of no less than 5 mils and applied through an electrostatic method to ensure proper adhesion. The aliphatic coating shall meet or exceed the following testing criteria:

1. Direct impact resistance of 140 in/lbs (per ASTM D 2794)
2. Taber abrasion loss no greater than 60.2 mg (per ASTM 4060)
3. Adhesion to substrate of 1500 PSI (per ASTM D 4541)
4. Salt fog resistance at 1400 hours (per ASTM B117-85)
5. Rust rating of 10 (per D 610)
6. Corrosion rating of 4 (per D 1654)
7. Blistering rating of 10 (D 714)

Manufacturer shall provide a touch up kit for site use.

C. Hardware. All bolts and nuts used in the assembly of the pumping system shall be zinc plated to retard Corrosion. Anti-corrosion washers to be used on each side of fastener.

2.3 Pumps

A. Scope.Pump station manufacturer shall strictly adhere to the following pump specifications. All pumps shall be manufactured and supplied by the pump system manufacturer.

B. Vertical Turbine Pumps. The main irrigation pump(s) shall be of the vertical turbine type with flow and head defined in the attached technical specifications.

1. The vertical turbine pumps shall be manufactured according to the standards of the Hydraulic Institute and to ANSI specification No. B58.1.
2. The bowl assemblies, column pipe, line-shaft, head shaft, and discharge head shall be of U.S. manufacture.

C. The pumping systems manufacturer shall have a network of service centers, which shall have available spare parts and trained pump technicians to handle service, repair and warranty procedures.

D. Pump Discharge Head. The pump discharge head shall strictly adhere to the following pump head specification.

1. The discharge head shall be of the fabricated steel type with a minimum 60,000 PSI tensile strength.
2. The discharge head shall have a working pressure of not less than 275 PSI and incorporate a 150 ANSI discharge flange.
3. The discharge head shall incorporate an integral air separation chamber, allowing air to be discharged through an air release line mounted on top of head.
4. Complete discharge head shall be hydrostatically tested to a minimum of 413 PSI.
5. A product lubricated high-pressure stuffing box containing at least six rings of packing and two lantern rings shall be provided. Packing shall be compressed around the shaft by an adjustable two-piece gland. Dual bypass tubing shall be included for proper packing lubrication and cooling. The discharge head stuffing box area shall also include a drain, which will be piped back to the wet well. Discharge head to be designed to include leakless configuration. Stuffing box bushing shall be SAE 660 Cast Iron.
6. The head shaft shall be of the two piece type, 416 stainless steel and shall be turned and ground. The pump manufacturer shall include a method for adjusting the impeller running clearance at the top of the head shaft. Adequate space shall exist to couple the head shaft and the line shaft above the stuffing box. Coupling shall be extra heavy duty AISI 416 SS with a minimum service factor of 2 to 1.

E. Pump Column Pipe. Column pipe shall be A53, Grade B schedule 40 material, in inter-changeable sections not more than 5 feet in length. Pump line shaft shall be AISI 416 SS. The size of the shaft shall be no less than determined by ANSI specification B58.1, Section 4.2, Table 4. Bearing retainers shall be bronze with rubber bearings.

F. Pump Wet End. The pump bowls shall be ASTM A48 Class 30 cast iron free of detrimental defects. All bowls larger than 8" should be of the flanged type construction. All pump bowls shall have porcelain enamel lined water passageways for high efficiencies.

1. The impellers shall be C83800 bronze and of the enclosed type design.
2. Pump shaft shall be AISI 416 SS turned and ground.
3. The shaft shall be supported by bronze bearings above and below each impeller.
4. The suction bell bearing shall be extra long and permanently greased packed and sealed with a bronze sand collar.

5. A stainless steel clip on type inlet strainer shall be mounted on the bottom of each pump.
6. Inlet area shall not be less than 4 times the suction bell inlet area.
7. Pump bowl assemblies shall be as manufactured by Goulds or approved equal.

2.4 Motor

A. Scope.All motors shall be of the same manufacturer. Pump station manufacturer shall strictly adhere to the following specifications.

B. Vertical Hollow Shaft Motor. Motor(s) for irrigation pump(s) shall be of the vertical Hollow shaft high thrust design.

1. Motor shall have a WP-I enclosure, 1.15 service factor, and class F insulation.
2. Motors shall be wound for the starting configuration as called out in the technical data sheet.
3. Design pump brake horsepower shall not exceed 98% of motor horsepower exclusive of service factor. Maximum pump run out horsepower shall not be greater than 8% higher than motor rating exclusive of service factor.
4. Motor shall be rated for continuous duty and be designed to carry the maximum thrust load of the pump and will have B10 bearing life of no less than 5 years.
5. Motors shall be rated and tagged for VFD service, proper ambient temperature and proper altitude per motor manufacturer recommendations.
6. Motors shall be as manufactured by U.S. Motors or approved equal.

C. Motor Space Heater. The pump station manufacturer shall provide on each pump motor a 120volt, single phase space heater of ample size to prevent condensation from occurring within the motor during non operating periods. The space heater shall be de-energized when the motor is running.

2.5 Valves and Gauges

A. Scope. Pump station manufacturer shall strictly adhere to the following specifications.

B. Pump Check Valve. Silent check valve shall be installed on the discharge of each pump between the pump discharge head and the pump isolation valve.

1. The check valve shall be of the silent operating type that begins to close as the forward flow diminishes and is fully closed at zero velocity preventing flow reversal and resultant water hammer or shock.
2. The valve design shall incorporate a center guided spring loaded disc, guided at opposite ends and having a short linear stroke that generates a flow area equal to the pipe size.
3. Valves shall be sized to permit full pump capacity to discharge through them without exceeding a pressure drop of 2.5 PSI.
4. All component parts shall be field replaceable without the need of special tools.

5. A replaceable guide bushing shall be provided and held in position by the spring. The spring shall be designed to withstand 100,000 cycles without failure and provide cracking pressure of 0.5 PSI and to fully open at a flow velocity of 4 ft/sec.
6. The valve disc shall be concave to the flow direction providing for disc stabilization, maximum strength, and a minimum flow velocity to open the valve.
7. The valve disc and seat shall have a seating surface finish of 32 micro-inch or better to ensure positive seating at all pressures.
8. The leakage rate shall not exceed one-half of the allowable rates for metal seated valves allowed by AWWA Standard C508 or 0.5 oz per hour per inch of valve diameter
9. The valve body shall be constructed of ASTM A126 Class B cast iron for class 125 and Class 250 valves.
10. The seat and disc shall be ASTM B584 Alloy C83600 cast bronze or ASTM B148 aluminum bronze covered in Buna-N to provide resilient sealing.
11. The compression spring shall be ASTM A313 Type 302 stainless steel with ground ends.
12. Valves 4" and smaller to be pressure rated for 250 PSI, 6" to 10" to be pressure rated to 150 PSI. Valves 12" and larger check valves to be globe style with 150 PSI rating.
13. Dual disc style check valves are not acceptable.

C. Pump Discharge Isolation Valve. Pump isolation valves shall be of the butterfly type with grooved ends to provide for expansion and vibration dampening and a lever operator.

1. Valve body shall be constructed of ductile iron with a polyphenylene sulfide coating.
2. Valve disc is rubber coated ductile iron.
3. Valve shall be rated to 200 PSI.
4. The pump isolation valve shall be sized as shown in the technical data sheet.
5. Isolation valve shall be as manufactured by Victaulic Or Grinnell Company or approved equal.
6. Lug style isolation valves are not acceptable.

D. Pressure Gauge. A pressure gauge shall be mounted on the discharge header with a ½" isolation ball valve.

1. All gauges shall be glycerin silicon filled to reduce wear due to vibration.
2. Accuracy shall be within 2%. Gauge diameter shall be 4" - 3 1/2" minimum.
3. Range shall be at least 50% higher than the highest pressure attainable from the pumps at shutoff head conditions.
4. The gauge shall incorporate a stainless steel back & bronze internal.
5. Pressure gauge shall be as manufactured by Wika or approved equal.

2.6 Electrical

A. Scope. To provide safe and reliable power and protection to all motors, control equipment and electrical devices. All electrical controls shall be U.L. Listed as an Industrial Control Device.

B. Codes. All wiring and controls shall comply with NEMA, N.E.C., and U.L. standards. The pump station including electrical components and enclosure shall be labeled as a complete U.L. listed assembly with manufacturer's U.L. label applied to the pump station. All equipment and wiring within the enclosure shall be labeled for proper identification. A complete wiring circuit and legend with all terminals, components, and wiring identification shall be provided

C. Surge Suppression. Electrical equipment shall be protected by a U.L. Listed Category C and Category B surge arrestor. The device shall adhere to IEEE C62.41 as a transient voltage surge suppressor. The suppressor shall withstand an impulse of 10,000 volts at 10,000 amps and a ringwave of 6000 volts at 500 amps. The pass voltage to a 480-volt device shall not exceed 1500V-1800V when subjected to an 8-millisecond by 20-millisecond waveform and shall meet or exceed the following performance criteria: 3720 joules minimum with a power dissipation of 82,500,000VA at 1800 volts maximum pass voltage to the protected equipment. Response time shall not exceed five nanoseconds.

D. Control Enclosure. Controls shall be housed in a NEMA 4 enclosure with integral latches. The control enclosure should be constructed of 12 gauge steel and the back plate assembly shall be constructed of 12 gauge steel. Enclosures 60 inches wide and larger shall use a back plate assembly 10 gauge steel or thicker. The enclosure shall be Powder coat painted or as specified in the paint specification listed under Section 2.0 Mechanical. Enclosure cutouts shall be laser cut for proper fit, sealing and coating retention. All indicating lights, reset buttons, speed potentiometer, selector switches and the operator interface device shall be mounted on enclosure door and be rated NEMA 4. All internal components shall be mounted and secured to the removable back plate assembly. A closed type cooling system shall be included to cool the enclosure and reject heat from the VFD and other source. Open type cooling systems allowing outside ambient air to enter the panel are not acceptable. No water line connections shall be permitted inside of the control enclosure. VFD status and internal parameters must be viewable without the opening of the enclosure door. Entire control panel shall provide minimum of 65KA short circuit protection. Control enclosure shall be lockable.

E. Main Disconnect. A fusible main disconnect shall be provided to completely isolate all controls and motor starting equipment from incoming power. Main disconnect shall possess a through the door operator, and shall be sized as shown in the technical data sheet including horsepower rating. Disconnect shall be as manufactured by ABB or Allen-Bradley or approved equal. Disconnect shall not be rated as a service disconnect. Fuses shall be sized to protect equipment in the enclosure sufficiently to permit a minimum 65KA Short Circuit Current Rating (SCCR).

F. Motor Starting Equipment—all motor starters for the pumping station shall be mounted in a NEMA (National Electrical Manufacturers Association) Type 4 Enclosure (or an IEC equivalent specification) as specified in Section 3.10. Motor starters shall meet IEC standards and shall be rated for a minimum of 1,250,000 operations. Each main irrigation motor shall have dual contactors that are both electrically and mechanically

interlocked to allow the VFD (Variable Frequency Drive) to operate on any of the motors, as specified in the technical data sheet. Motor overload relays shall be IEC Class 10 Rated with bimetal ambient compensated overload relays. Fuses shall supply short-circuit protection for each motor and shall be rated for a minimum 200,000 amperes interrupt capacity. Note: Motor overloads shall be manual reset only: auto-reset of motor overloads shall not be permitted.

G. Control Power. Power for the controls shall be provided by a control power transformer which will provide low voltage, single phase power for the pumping system control operation. Control power transformer shall not be used for any other external load. The control power transformer shall be protected on the primary side by current limiting fuses of adequate size and voltage rating. All control components will be protected by time delay circuit breakers of adequate size. The control power transformer shall be as manufactured by Sola or approved equal.

2.7 Station Controls

A. Scope. To provide complete instrumentation and controls to automatically start, stop and modulate pump speed(s) to smoothly, efficiently and reliably pump variable flow rates at a constant discharge pressure. Full alarms and safety features needed to protect the equipment and irrigation piping system. All electrical controls shall be U.L. Listed as an Industrial Control Device.

B. Motor Starting Equipment. All motor starters for the pumping station shall be mounted on a single back panel in a single NEMA 4 enclosure as specified in section 3.10. Motor starters shall meet I.E.C. standards and shall be rated for a minimum of 1,250,000 operations. Each main irrigation motor shall have dual contactors, which are both electrically and mechanically interlocked to allow the VFD to operate on any of the motors as called out in the technical data sheet. Motor overload relays shall be I.E.C. rated class 10 ambient compensated. Fuses shall supply short circuit protection to each motor and shall be rated for a minimum 200,000 amp interrupting capacity. Motor starters shall be as manufactured by Allen Bradley or approved equal. Motor over-loads shall be manual reset only. Auto-reset of motor overloads shall not permitted.

C. Variable Frequency Drive. The variable speed drive shall be a digital, pulse width modulation (PWM) variable frequency drive (VFD) with IGBT transistors. The VFD shall include a 3% input line reactor to protect against voltage transients. The VFD shall have a minimum wire to wire efficiency of 98.5%, and shall be rated up to 550 volt operation in order to eliminate nuisance tripping at marginally high voltage conditions. Incoming power end shall be protected by fast acting semiconductor fuses. Any VFD error messages shall be displayed on a 80 character LCD readout in English or any one of 11 other languages. The following fault protection circuits shall be included: Overcurrent (240%), Overvoltage (130%), Undervoltage (65%), Overtemperature (70 Deg. C), Ground fault, and motor overload. The VFD shall be capable of starting into a rotating load and accelerate or decelerate to setpoint without safety tripping. The VFD shall have an automatic extended power loss ride through circuit which will utilize the inertia of the pump to keep the drive powered. Minimum power loss ride-through shall

be one cycle based on full load and no inertia. The VFD shall be optimized for a 3 kHz carrier frequency to reduce motor noise. The VFD shall employ three current limit circuits to provide "tripless" operation. The following operating information shall be displayed on the VFD LCD: KWH, elapsed time, output frequency (Hz), motor speed (RPM), motor current (amps), and voltage. Line reactor will be installed on input of VFD to protect against voltage transients. The VFD LCD display shall continuously scroll through all operating information and shutdown faults while the drive is running and while stopped. The information shall be viewable through a water tight plexiglass window on the control panel door as specified in Section H. VFD shall be as manufactured by ABB or approved equal.

D. Instrumentation. Instrumentation and sensory devices shall monitor pressure, flow and other necessary system criterion. All instrumentation shall be installed in adherence to UL and manufacturer specifications. Analog isolation shall be utilized on all analog signals originating off the skid and whenever necessary.

E. Pressure Transducer. Pressure transducer shall provide analog pressure signals for the control logic. Pressure transducer shall be a solid-state bonded strain gage type with an accuracy of plus/minus 0.20% and constructed of 316L stainless steel. Transducer shall be rated for station discharge pressure as shown on technical data sheet, and shall provide gauge pressure output, rather than an absolute. Pressure transducer constructed of plastic is not acceptable. Threshold transducers are not acceptable. Pressure transducer shall be as manufactured by GEMS or approved equal.

F. Magnetic Flowmeter. The pump station shall have a flow sensor installed, which shall be utilized for control and to display the pump station flow rate, and to display total flow through the pump station controller operator interface device (OID). Flow meter shall be electro magnetic flow meter comprised of two major components, a primary head and a signal converter. Flow meter signal converter shall produce two separate signals, pulse and 4-20mA, in linear proportion to flow rate. Flow meter shall read flows from 0-40 fps, with a worst case inaccuracy of 0.5% of indicated value (not a percentage of full scale) at 1.3 fps or greater. Flows under 1.3 fps shall have a lower accuracy with accuracy applying to indicated value (not full scale). Flow meter shall be sized so that maximum system flow lies between 16 and 24 fps through the meter. Meter shall be installed according to manufacturers recommendations. Manufacturer shall have a US based manufacturing and assembly center. Flow meter shall be as manufactured by Krohne or approved equal.

G. Programmable Logic Controller (PLC). One or more industrial grade programmable logic controllers shall handle all control logic. The PLC(s) shall provide demand controlled sequential pump start-up, shutdown and safety features through pressure sensing, flow sensing and voltage sensing devices. An LED visual status light is provided for each I/O point to indicate on/off status. PLC shall be provided with a built in non-volatile EEPROM chip. Industrial grade programmable logic controllers shall handle all logic for system control, timing, and control of VFD speed.. All PLCs shall have a built in clock calendar and shall communicate via the internal-100megabit Ethernet network. PLC shall posses a minimum of 1.5 megabytes of total memory and shall meet the following use-specific memory requirements: 256k for inputs, 256k for outputs, 512k available for programming and 256k used as data space. The PLC shall be as manufactured by WAGO or approved equal.

H. Human Machine Inferface Device (HMI). The pump station shall include a NEMA 4, 320 x 240 resolution, 64K color touch screen display mounted on the control panel door. This device shall allow the operator to view and selectively modify all registers in the PLC. The unit shall store its messages in non-volatile memory. The human machine interface device shall incorporate password protection for protecting data integrity. The device shall allow display and modification of all timers, set points, lockout times, etc. The device shall communicate with the PLC through the internal Ethernet network.

I. Operation and Control. Control software shall be parameter driven, fully documented, and allow user to easily change ALL operational parameters. Standard control features and equipment which need to be included as a minimum are as follows:

1. Panel face switches and lights: Controls shall be designed so operator can discretely start and stop all pumps in all modes of operation including manual mode, operator interface failure, VFD bypass and PLC bypass modes with enclosure doors closed and disconnect switch fully engaged. Enclosure shall include the following switches/ or indicator lights:

    a. Individual pump run lights
    b. Individual pump Hand / Off / Automatic switches
    c. System Test / Off / Automatic switch
    d. Mode select switch – allows automatic bypass mode of operation which can be used in the event of VFD failure
    e. VFD selector switch – in manual mode, the lead pump will run on the VFD and each lag pump will start across the line
    f. Reset – Acknowledges pump station alarms
    g. Speed potentiometer – in test mode allows user to adjust VFD pump speed
    h. Low discharge pressure override switch – disables low discharge pressure alarm Individual pump run lights

2. The Station shall posses the following Alarms as a minimum, and may employ addition job specific alarms, safeties, and shutdown faults as needed. All alarms will be indicated by a red general alarm light. Alarm conditions along with procedures for correction will be displayed in English on the human machine interface device (HMI). Three unsuccessful restarts in 60 minute period will give hard shutdown.

    a. Low discharge pressure
    b. High discharge pressure (Attempts restart)*
    c. Low water level (Attempts restart)*
    d. Phase loss (Attempts restart)*
    e. Low voltage (Attempts restart)*
    f. Phase unbalance (Attempts restart)*
    g. Phase reversal (Attempts restart)*
    h. Individual motor overload/phase loss (indicates which individual motor was shut down) Manual reset only. Automatic reset is not acceptable.
    i. VFD fault (shutdown VFD pump only and attempts restart)*

3. Fifteen distinct set point pressures (normal, lockouts 1 & 2, and 3 high elevation). The lockout feature gives the user the flexibility to lower the set point pressure automatically at days and times, and "locking out" the operation of one or more of main pumps if local power authority imposes penalties for operating these pumps during such times. It also allows user to set a maximum RPM for the VFD pump during these lockout times so that user can limit amperage draw during penalty periods. The high elevation set point can be tied into a computerized irrigation system, or directly linked to high elevation satellites. When high elevation satellites are operating, control software will automatically and gradually elevate the pressure to the new desired set point. When finished, the high set point will be lowered back to normal. The high elevation set point will only be used if called out on the technical data sheet.
4. Software will be included to automatically and gradually ramp up irrigation system pressure to the desired operating pressure (i.e., 1 PSI every 4 seconds) without overshooting design pressure. This feature operates whenever pressure drops below set point pressure. This ramp up time is fully adjustable by the operator. This control feature is based on an increase in pressure over a pre-defined time period. The acceleration control on the VFD is NOT an acceptable means of adjusting pressure ramp up speed.
5. Software will be included for optionally maintaining a lower irrigation system pressure when not irrigating. Reduced pressure values will be shown in the technical data sheet. Controls will cycle the PM pump at these reduced pressures during non irrigation times and pressure will gradually increase to design pressure when the irrigation periods begin.
6. Neither flow meter nor VFD output frequency shall be used for shutting down last VFD driven pump. Controls and software shall incorporate a method to eliminate excessive cycling of VFD pump at very low flow conditions, yet not run the pump excessively at no flow conditions.
7. Automatic alternation of VFD driven pumps. This shall be accomplished by incorporating dual mechanically and electrically interlocked contactors allowing alternation of the VFD between pumps. The controls shall alternate pumps based on individual run time allowing each pump to acquire equal operation.
8. Real time clock calendar allows PLC to internally provide all date ,time and day of week functions used above.
9. Two separately adjustable PID control loops for both low flow and high flow pressure stability.
10. User shall be able to field select either of two modes of VFD operation. Auto switch VFD option allows VFD to sequentially start each pump. The standard mode of operation starts the first main pump on the VFD and the remaining pumps start across the line as required.
11. Shutoff algorithm for fixed speed pumps to minimize pump cycling while also remaining responsive to sudden flow reductions. Minimum run timers alone for minimizing fixed speed pump cycling is not acceptable. Discharging through relief valve during pump transitions is not acceptable.
12. Full manual operation capability with panel face mounted speed potentiometer for manually adjusting VFD speed.
13. Light test sequence: Activating the lamp test sequence on the HMI illuminates all lights for 5 seconds.

14. All pump station shutdowns shall be of the controlled type that sequentially retires pumps at user selectable intervals to reduce water hammer within the irrigation system. Phase fault shut-down shall have accelerated rate to minimize motor damage. All pump system shut downs shall be of a controlled type that sequentially retire pumps at intervals appropriate to the specific individual alarms.
15. The pump station software program shall be user friendly enough to enable the set point pressure from being raised or lowered by the end user at the pump station or through the remote monitoring software package if provided. The pump station software ladder logic shall be written in such a way that no other value would require changing if the set point pressure had to be adjusted. Pressure maintenance pump and main irrigation pump start pressures, the pressure maintenance pump stop pressure, low discharge shutdown and high discharge shutdown shall not be at a specific value but a differential pressure off of set point (i.e. pressure maintenance pump (PMP) to start 5 psi below set point and stop 5 psi above setpoint).

J. Sequence of Operation. During non irrigation times, the pressure maintenance pump (PM) will cycle on and off as required to maintain irrigation system pressure. The start and stop pressures shall be a differential off of set point. The cycling pressures can be user selected and can be set substantially below normal set point pressure, if desired. If the PM pump cannot maintain the desired pressure, then the VFD will start the first pump and will gradually ramp the pressure up to desired irrigation pressure. The start pressure of the VFD pump shall be a differential below the set point. The pump speed will be modulated to hold a constant discharge pressure regardless of flow. As the flow rate increases and the VFD pump can no longer maintain pressure while at maximum speed, the next sequential pump will be started and the VFD driven pump will accordingly reduce its speed and modulate. An algorithm shall be included for accurately reducing the VFD pump speed as the next sequential pump is started so that no pressure surges are generated during the transition (even with across the line starting). If the user prefers to switch the VFD from pump to pump for sequential starting, he can select this option with the HMI. As the flow continues to increase, pumps will sequentially be started until all pumps are running. As the flow begins to decrease, pumps will be sequentially turned off until only a single VFD driven pump is operating. When a no flow condition occurs, PLC must check and verify pump curve position prior to station shutdown.

K. PLC Automation Program. The pump station software program shall be user friendly and intuitive. enough to enable the set point pressure from being raised or lowered by the end user at the pump station or through the remote monitoring software package if provided. The pump station software ladder logic shall be written in such a way that no other value would require changing if the set point pressure had to be adjusted. Pressure maintenance pump and main irrigation pump start pressures, the pressure maintenance pump stop pressure, low discharge shutdown and high discharge shutdown shall not be at a specific value but a differential pressure off of set point (i.e. pressure maintenance pump (PMP) to start 5 psi below set point and stop 5 psi above setpoint).

L. HMI Automation Program. The following information and control screens shall be provided as a minimum to give the user detailed, accurate, and easily understandable operational information. The following screens will enable the user to make real-time changes to the station's control software. This information shall also be accessible through the internet if the station has internet access.

1. Pressure, Flow and System Status: The current pressure, flow, VFD RPM and a system status overview shall be displayed. Codes or Fault's ID numbers shall not be adequate.
2. Current Condition of all Alarms: The input state and alarm state, for all active alarms shall be shown.
3. Pump Runtime and Starts: Runtime and number of starts for each pump shall be readily. The starts and runtime must be verified by electrical pump feedback. The OID will include a grand total and since reset value for each pump.
4. Alarm History: The last nine alarms shall be stored in PLC Memory with detailed information about time, pressure and flow at the time of occurrence. The log will also include diagnostic and recommendations for correction of condition.
5. Total Flow Output: This total shall include a grand total since commission and a total since reset.
6. Stations Events: The last 255 events shall be stored in PLC memory. This will include all alarms, individual pump starts and stops, and change in system status.

M. Networking and Communication. Station shall utilize Ethernet communications as defined in IEEE 802.3. An industrial grade 8-port Ethernet switch shall be provided for star topology connection between PLC(s), HMI, and wireless communication devices if present. An unintelligent Ethernet hub shall not be acceptable. The router shall also provide a field service point of connection without disconnecting any devices from the Ethernet network. All Ethernet communication cable shall be category 5 multiple twisted part wire terminated by RJ45 connectors. An RJ45 terminal shall be installed in the enclosure door to provide network connectivity without opening the enclosure.

N. The pump system manufacture shall provide radio's for communication to the maintenance facility or internet accessible location. The radios shall be license free 900 MHz supporting TCP. The radios shall adhere to the following specification.

1. Input voltage 6-30 Volt DC
2. Low current draw <140mA full time receive and ,550 mA transmit current
3. 154 Kbbs over-the-air throughput
4. Point-to-point range of 60 miles with clear line of site.
5. Point-to-multipoint range of 60 miles with clear line of site.
6. Error free communications with 32 bit CRC with automatic retransmission
7. RF performance from -40°C to +75°C

O. Transmitter

1. Frequency Range - 902-928 MHz (FHSS)
2. Output power - 5 mW to 1 W

3. Modulation – 2 level GFSK
4. Occupied bandwidth – 230.4 kHz
5. Hopping patterns – 15 per Band, 105 total (user selectable)
6. Hopping channels – 112
7. Hopping bands – 7 (user selectable)
8. Frequency zones – 16 zones, 7-8 Channels per zone
9. RF Connector – TNC

P. Receiver

1. Sensitivity - -110dBm for BER 1x104 at 153.6 kbs
2. Selectivity – 20dBat fc ±230 kHz
3. System gain – 140 dB

Q. Data Transmission

1. Error Detection – 32 bit CRC, retransmit on error
2. Data Encryption – AES 128 bit encryption and proprietary spread spectrum technology
3. Authentication – Radius
4. Data Interface – Ethernet
5. Protocol – Ethernet: IEEE 802.3 TCP/IP, DHCP, ICMP, ARP multicast TFTP
6. Data Connector – Ethernet 10/100 Base T Auto-crossover and 2x serial DB9

R. Toro Lynx Interface.

1. The pump station controls shall communicate with Toro Lynx central and allow for the following features.

    a. The pump station will provide constant pressure, flow and alarms to the Toro Lynx central on the menu bar in the Toro Lynx screen.
    b. The pump station will continuously provide status information to the Toro Lynx system to allow for fault indication of any pump and provide the ability to recalculate flows based upon available pumping capacities.
    c. The pump system shall be equipped with APS (automatic power saver) to allow the user to reduce the set point pressure during non irrigating hours. If selected the Toro Lynx system shall instruct the pump system to go into APS mode to a set point pressure set by the end user.
    d. Prior to irrigation program cycle the pump station shall automatically start and come up to set point pressure. If the station is equipped with filtration the filters will be pre-flushed prior to the irrigation cycle.
    e. The pump system shall be equipped with individual motor CT's to provide power usage back to the Toro Lynx central. The user through the Toro Lynx Power Guard system shall be able to limit the amount of power consumed by the pump system during any hour of the day. The Toro Lynx system shall automatically re-calculate the water window based on the power reduction.

2.8 Valve and Filter.

A. The pump station manufacturer shall furnish a V-Series automatic self-cleaning screen filter(s). The filter(s) shall provide uninterrupted filtration as detailed in the technical specifications.

B. Operation

1. Water shall flow into the 316 stainless steel filter body and through the 316 stainless steel weave-wire filtering screen from the inside out allowing blocked contaminants to accumulate on the inside surface of the filtering screen.
2. Differential pressure across the filtering screen shall be continuously monitored as the filter cake builds on the inside of the filtering screen. When the differential pressure reaches an adjustable threshold, a flush cycle shall be initiated by the opening of a flush valve. The opening of the flush valve drops the pressure inside the drive chamber allowing flow to reverse through the suction scanner nozzles. The suction scanner nozzles transfer this reduced pressure at the nozzle location onto the inside of the filtering screen surface. This reduced pressure on the inside of the filtering screen creates a reversed flow through the filtering screen, pulling the contaminants off the screen, back through the suction scanner nozzles and out the flush valve. Once the nozzles have traversed and cleaned the entire screen surface, the flush valve shall close stopping the flush cycle. The filtering process shall remain uninterrupted during the flush cycle.

C. Cleaning Mechanism

1. The filter cleaning mechanism shall provide a controlled spiral path for the suction scanner nozzles across the inside surface of the filtering screen. The opening of a 1 inch NPT flush valve shall create suction forces at each of the 2 suction scanner nozzles creating a reversed flow back through the filtering screen. The reversed flow back through the filtering screen shall force the contaminants from the filtering screen, back through the suction scanner nozzles and out the flush valve.
2. The surface area of each suction scanner nozzle shall not exceed 0.20 square inches to provide minimal flush waste.
3. The optimum distance of the suction scanner nozzle to the screen shall be fixed by the manufacturer and shall not be adjustable to prevent the reduction of manufacturer's designed cleaning performance.
4. The flush flow shall not exceed 30 gpm at 35 psi.
5. Each cleaning cycle shall be completed in less than 15 seconds to further minimize flush waste.
6. The minimum pressure required shall be 35 psi to assure high cleaning efficiency.
7. The cleaning mechanism assembly shall be constructed of 316 stainless steel.
8. The suction scanner nozzle assembly shall be constructed of CPVC.

D. Drive Mechanism

1. The simplicity and cleaning efficiency of any self-cleaning screen filter is in the mechanical system that drives the cleaning process.
2. For simplicity, the drive mechanism shall not consist of electric motors, limit switches and/or actuated pistons that return the drive mechanism to its start position.
3. For cleaning efficiency, the drive mechanism shall allow the suction scanner nozzles to traverse across the screen and return to their start position, and if required, to continue this cycle indefinitely without interrupting the flush flow.
4. Drive systems that do not continuously clean as the suction scanner nozzles return to their start position will not be accepted.
5. The suction scanner shall be driven by a hydraulic motor directly attached to the suction scanner. The hydraulic motor shall utilize the flush waste flow during the flush process to provide forces that rotate the suction scanner. The suction scanner shall rotate on a double axial spline that allows the suction scanner nozzles to traverse across the screen and return to their start position without interrupting the flush process and without the aid of return mechanisms such as electric motors, limit switches and/or actuated pistons. Each suction scanner nozzle's rotation shall overlap with its prior rotation by no less than 10%.
6. The drive mechanism shall include a pressure balance line. This pressure balance line shall balance forces on each end of the suction scanner to reduce forces on the drive mechanism, thereby minimizing mechanical wear and flush waste.

E. Filtering Element

1. The filtering screen element shall be 316 stainless steel weave-wire with 200-micron openings.
2. The filtering element shall consist of 3 layers constructed of 316 stainless steel, and shall be fabricated to allow for maximum open area and strength.
3. The filtering element layers shall be the 1) filtering screen, 2) dispersion screen and 3) the structural screen.
4. The fine filtering layer shall have no other layers between it and the suction scanner nozzles to assure contaminants are not trapped between layers during the flush cycle.

F. Filter Housing Construction

1. The filter housing and cover shall be manufactured from 316 stainless steel and shall be manufactured to ASME code.
2. Filter housing and internal assembly seals shall be constructed of EPDM.
3. Internal pressure shall not exceed 150 psi and operating temperature shall not exceed 176o F.
4. The filter body assembly shall be capable of accepting interchangeable filtering screen elements down to 10 micron.
5. Filter flanges shall conform to AWWA Class D. Filter body coatings shall not be required.

G. Filter Controller

1. The filter(s) control system shall control all aspects of each filter's operation. The filter(s) control system and/or control logic shall be provided by the filter manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for providing all materials, equipment, and labor necessary to install all items associated with the pump station.

3.2 ON-SITE PUMP STATION OFF LOADING & SETTING

A. Off-loading & setting of the pump station is the responsibility of the contractor, unless specifically called out elsewhere in the specification. Crane to off-load and set the pump station on the concrete slab is to be provided by contractor.

3.3 ON-SITE PUMP STATION START UP

A. Technical start up shall be furnished by the pump station manufacturer or a qualified, certified service agency. Location and mounting details shall be furnished by the pump station manufacturer. Electrical connection, by Contractor, shall consist of a single conduit from City of NY disconnect to the pump station main disconnect. Additional Contractor responsibility shall include confirming correct motor rotation and securing local inspection/approval.

B. Technical start up procedures by the pump station technician shall include the following:

1. A minimum one-week notice shall be given to manufacturer prior to scheduled start up date.
2. During start up, the complete pumping system shall be given a running test of normal start and stop, and fully loaded operating conditions.
3. During this test, each pump shall demonstrate its ability to operate without undue vibration, or overheating and shall demonstrate its general fitness for service.
4. All defects shall be corrected and adjustments made at the expense of the pump station manufacturer. Test shall be repeated until satisfactory results are obtained.
5. Start up assistance will be provided but will be limited to one 8-hour day unless otherwise specified.
6. After the station startup has been completed, but before leaving the job site, an instruction session will be given. The instruction session will be given to the City of NY to familiarize them with the pumping system operation, maintenance and adjustments.

3.4 M & O Instruction and Demonstration

A. After testing is completed and approved by the Commissioner, a instruction and demonstration session shall be held for the M&O staff. The installed pump station shall be demonstrated for one day (maximum 6 hours) for the district M & O Staff. The demonstrations shall include manual and automatic operation of the pump station. The demonstration shall also include identification and operation of each component, trouble shooting for each component, winterizing the system, removal and replacement of defective components, general and specific requirements for the system maintenance, and a check list for frequent attention of components. Highlights of the demonstration, including identification of components shall be videotaped for future M&O instruction.

3.5 O & M Manual

A. The Contractor shall furnish four (4) copies of the O & M Manual (Operation & Maintenance Manual) for the pump station and the associated mechanical systems. Operation and maintenance manuals shall be furnished at time of start up and initial training The manual shall include a checklist for trouble shooting and corrective measures in addition to operation and maintenance instructions.

END OF SECTION 328001

SECTION 328002

MANUAL IRRIGATION SCHEDULING

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (I) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 GENERAL REQUIREMENTS

A. Work Plan

1. Submit a detailed work plan within 120 days for the irrigation of the plant material for the entire grow-in and maintenance period. List who is responsible for each task, and when the tasks will be completed.

B. Irrigation Products

Water efficiently to conserve water, tree bags, hoses should have adjustable nozzles. The use of water saving technologies is such as drip irrigation, automatic controllers, efficient sprinkler heads is encouraged.

C. Irrigation Map Drawings:

1. Irrigation schedule map drawings shall be a reproduction of the planting plan identifying areas of low, medium and high water use. Drawings shall be reduced and printed on 11" x 17" 24lb bond paper. Drawings shall be legible and created using AutoCAD. If necessary, use multiple sheets of paper and place drawings back to back.

2. Irrigation map drawings shall show areas of low, high and medium water use highlighted in a different color hatch pattern with the designated landscape area numbered: Lawn 1, Planter 1, Tree 1 etc.

3. Seal drawings in 10 mil plastic laminate. When multiple drawings are required punch a hole in the upper left had corner of the laminate and connect with a key chain loop.

D. Irrigation Schedule:

1. Create a typewritten monthly schedule on 8 ½" x 11" white paper listing each area of the irrigation map drawing. Include a description of each zone (ie Lanwn 1, Planter 2 etc), days to water per week and daily watering times for each irrigation month. Irrigation run times are to be based the chart "A" below using historical evapotranspiration and rainfall data for the location.

2. Example of Irrigation Schedule:

Zone	Days	Description	April	May	June	Jul	Aug	Sept	Oct
1	MWF	Planter 21	15:00	17:00	25:00	25:00	30:00	18:00	8:00
2	TTH	Lawn 1	15:00	17:00	25:00	25:00	30:00	18:00	8:00
3	TTH	Planter 15	5:00	6:00	8:00	12:00	13:00	9:00	6:00
4	TTH	Planter 21	5:00	6:00	8:00	12:00	13:00	9:00	6:00

3. Seal irrigation schedule in 10 mil plastic laminate.

4. All irrigation equipment must have their gpm determined to properly determine the watering rates. If irrigating with a hose you must determine the gpm by filling a 5 gallon bucket and timing it. Discharge rates of all nozzles should be known.

5. Install a rain gauge to help determine if irrigation is required.

6. CHART "A":

ITEM	SOURCE		VALUE	UNIT or FUNCTION
I. PLANT WATER REQUIREMENT				
A. PLANT MATERIAL	Planting Plan			classification
B. REFERENCE PERIOD	Monthly			days
C. REFERENCE ET (ET_o)	Various sources			inches of water
D. LANDSCAPE COEFFICIENT (K_L)	K_s x K_d x K_{mc}			plant specific multiplier
(Optional) ALLOWABLE STRESS	K_L ____x K_{as} ____			site specific multiplier
E. PLANT WATER REQUIREMENT (ET)	ET_o x K_L	C x D		inches
II. IRRIGATION WATER REQUIREMENT				
F. PRECIPITATION RATE (PR)	Calculation			inches per hour
G. DISTRIBUTION UNIFORMITY (DU)	Estimate			efficiency adjustment
H. IRRIGATION WATER REQUIREMENT	ET requirement	E/G		inches
I. TOTAL RUN TIME per PERIOD	Irrig. water requirement/PR	(H/F)x 60		minutes
III. SCHEDULING REQUIREMENTS				
J. ROOT ZONE SOIL TYPE	Audit or Estimate			classification
K. AVAILABLE WATER (AW)	Table			inches per inch of soil
L. ACTIVE ROOT ZONE DEPTH	Audit or Estimate			inches
M. PLANT AVAILABLE WATER (PAW)	AW x active root zone	K x L		inches
N. ALLOWABLE DEPLETION (AD)	PAW x MAD (see Table)			budget multiplier
O. IRRIGATION DAYS PER PERIOD	Plant ET/AD	E/N		days in a period
P. TOTAL RUN TIME per DAY	Total run-period/irrigation days per period	I/O		minutes
Q. RUN TIME per CYCLE	Calculation (IR/PR x 60) or Visual observation			minutes
R. CYCLES per DAY	Total run-day/run time-cycle	P/Q		repeats to avoid runoff

END OF SECTION 328002

SECTION 329113

PLANTING SOIL MIXES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Ammended Existing Topsoil
2. Ammended Imported Topsoil

1.3 RELATED SECTIONS

A. Project Specific Sustainability Requirements - Section 013010

B. Exterior Plantings – Section 329300

C. Plantings for Wetland Areas – Section 327200

D. Soil Mixes for Wetland Areas – Section 327500

E. Vegetated Roofing System – Section 073360

1.4 REFERENCES

A. Except as modified by governing codes and by the Contract Documents:

1. Association of Official Agricultural Chemists
2. American Society for Testing and Materials (ASTM) using test criteria as specified or required by other references
3. Soil Science Society of America, Methods of Soil Analysis
4. US Composting Council, Test Methods for the Examination of Composting and Compost (TMECC).
5. Environmental Protection Agency (EPA).

1.5 SUBMITTALS

A. General:

1. All submittals shall be marked with the following information:

a. Date issued

b. Project Title and names of Contractor and material supplier.

c. Name of material and reference number from Part 2 of the specifications.

d. Date, place, and time of sampling.

e. Location of material source.

2. No base component material for plant mix shall be used until certified test reports and component samples have been received and approved by the Commissioner.

3. Commissioner may request additional testing by Contractor for confirmation of mix quality and / or soil mix amendments at any time until completion.

B. Product Data: Submit to Commissioner technical data for each manufactured or packaged product of this section. Include manufacturer's product testing and analysis, and installation instructions for manufactured or processed items or materials. Provide submittal twelve weeks before the installation of the Topsoil Mix.

C. Material Source Location: Submit locations of soil material sources. The Landscape Architect shall have the right to reject any material source. Provide submittal twelve weeks beforee the installation of the Topsoil Mix.

a. Submit the name, address and telephone number of the source contact, and the location of the soil source including driections to the specific field location on the property.

D. Material Certificates:

1. Submit to Commissioner certified analysis for each planting soil, amendment, and fertilizer material specified and as used. Include guaranteed analysis and weight for packaged material. Provide submittal twelve weeks before the installation of Topsoil Mix.

2. Submit the manufacturers certificate for all sand to the Commissioner for approval, the manufacturer's pH, and particle size analysis.

Provide the following particle size distribution (percent passing):

Sieve

3/8" (9.5mm)
No 4. (4.75mm)
No 8. (2.36mm)
No 16 (1.18mm)
No 30 (.60mm)
No 50 (.30mm)
No 100 (.15mm)

3. Submit the manufacturers certificate including the manufacturer's Fines Modulus Index, for all sand to the Commissioner's approval.

4. Prior to job acceptance, submit to the Commissioner written certificates for the following total quantities by weight as used on the Project Site for Project materials:

a. Quantity and type of topsoil, commercial fertilizer, organic fertilizer, or organic amendment.

E. Testing: Submit soil test analysis report for each sample of Topsoil from an approved soil-testing laboratory.

1. For all Topsoil provide a particle size analysis (% dry weight) including the following gradient of mineral content:

USDA Designation	Size in mm
Gravel	+2mm
Very Coarse Sand	1-2mm
Coarse Sand	0.5-1mm
Fine Sand	0.1-0.25mm
Very Fine Sand	0.05-0.1mm
Silt	0.002-0.05mm
Clay	Minus 0.002mm

2. For all Topsoil provide a particle size analysis (% dry weight) including the following gradient of mineral content:

USDA Designation	Size in mm
Gravel	+2mm
Sand	0.05-2.0mm
Silt	0.002-0.05mm
Clay	Minus 0.002mm

3. For all Topsoil provide a chemical analysis including the following:

a. pH and Buffer pH

b. Percent organic content by oven dried weight

c. Nutrient levels by parts per million including: nitrate, phosphorus, potassium magnsium, manganese, iron, zinc, and calcium. Nutrient test shall include the testing laboratory recommendations for supplemental additions to the Topsoil Mix.

d. Soluble salt by electrical conductivity of a 1:2 soil water sample measured in Milliohm per cm.

e. Cation Exchange Capacity (CEC).

4. Provide a physical analysis of each Topsoil to include the following test results:

a. Water permeability with the sample compacted to 80% and 85% maximum proctor density utilizing proctor test (ASTM D 698-12e1).

F. Samples: Submit samples of each product and material where required by the specification to the Commissioner for approval. Submit all samples in re-sealable plastic bags. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the contractor. Delivered materials shall closely match the color, texture and consistency of the samples.

1. Submit two-gallon samples of all topsoil, sand, compost, and Topsoil Mixes, and soil additive products in this section. The number of samples shall be as required for each material.

    a. Samples of all topsoil, sand, compost and Topsoil Mixes shall be submitted at the same time as the particle size and physical analysis of that material.

    b. Topsoil Mixes shall be labeled as to the percentage of each component in the mix.

    c. Samples of all products and Topsoil Mix components shall be submitted twelve weeks before the installation of Topsoil. Topsoil Mixes shall be submitted no more than two weeks after the approval of the mix component.

G. Soil Mixing Procedures: The Contractor shall submit a detailed soil mixing operations plan. This plan shall include types of equipment, descriptions of procedures, stockpiling plan and shipping methods.

H. Soil Planting and Grading Procedures: The Contractor shall submit a detailed soil placement, blending and grading operations plan. To the degree possible, soils shall be amended in place

I. Submittal Summary

Item/Product	Section	Test/Submittal Summary. Referred to sections for specific requirements.
Soil Survey	3.2	Particle size analysis see 1.6E for required test Chemical analysis see 1.6E for required test
Topsoil	2.2	3 lb. sample from each source, samples shall represent the range of material to be provided. Separate samples from screened and unscreened topsoil stockpiles
	1.6E 2.2	Particle size analysis see 1.6E for required test
	1.6E 2.2	Chemical analysis see 1.6E for required test
Composted Organic Matter	2.3	2 gallon sample
	2.3	Manufacturers certificates of compliance showing:

		pH, particle size analysis, certificate of length of composting period, and certificate that the compost meets the requirements of the US Composting Council.
Composted Pine Fines	2.4	3 lb. sample
	2.4	Manufacturer's certificate of complicance showing: pH, particle size analysis, certificate of length of composting period, and certificate that the compost meets the requirements of the US Composting Council.

1.6 QUALITY ASSURANCE

A. Soil Installer Qualifications: All soil work shall be performed by an experienced contractor who has completed soil work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

B. Installer Field Supervision: Require installer to maintain full-time supervisor during times soil work is in progress.

1. Installation and maintenance foreman on the job shall be competent supervisor experienced in supervising soil installation. A single Installer Field supervisor shall be assigned to the project for its duration. In the event that the designated supervisor cannot be on the site, a replacement supervisor shall be approved by the Commissioner.

C. Soil Mix and Soil Component Testing

1. Agency Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and specializes in types of tests to be performed, or a member of the Council on Soil Testing and Plant Analysis and has staff members with extensive agricultural research experience as demonstrated with peer reviewed publications. The lab shall be accredited by the A2LA (American Associatation for Laboratory Accreditation). The soil testing laboratory shall be approved by the Commissioner in advance and have a minimum of 3 years experience with the test protocols of the United States Golf Association – Green Section.

2. Testing of soils and Planting soils shall be performed by either:

Turf & Soil Diagnostics
35 King Street

Trumansburg, New York 14886
Tel: (607) 387-5694

Rutgers Soil Testing Laboratory
Rutgers, The State University of NJ
57 US Highway 1
New Brunswick, NJ 08901
Tel:(848) 932-9295

LCL Labs
325 Venture Drive
Westerville, Ohio 43081
Tel: (614) 888-1663

Woods End Research Laboratory
P.O. Box 297
Mt. Vernon, ME 04352
Tel: (800) 451-0337

Or approved equal

3. Laboratory comments or recommendations regarding amendment requirements or procedure shall not be interpreted to prescribe or dictate procedures or quantities of soil materials for the work of this Contract. Final approval of soil amendment procedures shall be approved by the Commissioner.

D. Soil Supplier:

1. Planting Soil Mix supplier shall have a minimum of five years experience in supplying custom planting mixes. Pre-approved soil suppliers are:

   Island Topsoil, Syosset, New York

   Long Island Compost, Yaphank, New York

   Natures Choice , Jersey City, New Jersey

   New York Recycling and Materials, Inwood, New York

   Or Approved Equal

2. Submit supplier name, address, telephone, fax numbers, email address, and contract name for approval by the Commissioner.

3. Submit certification that the accepted supplier is able to provide required quantities of materials and mixes for the entire project.

E. Pre-Installation Conference: Contractor to conduct a conference at the Project. Person(s) responsible for soil preparation and installation of soil required by this Section shall attend to review soil placement and grading procedures and methods. The Installers field supervisor shall attend all soil pre-installation conferences.

F. Review of Work by the Commissioner: The Contractor shall comply with the requirements of the plans and specifications regardless of review or lack of review by the Commissioner.

1. Failure of the Commissioner to reject unsatisfactory workmanship or to notify the Contractor of their responsibility to repair and/or replace unsatisfactory work shall not constitute acceptance of the work.

2. The Commissioner reserves the right to take and analyze, at any time, such additional samples of materials as deemed necessary for verification of conformance to specification requirements. Contactor shall furnish samples for this purpose upon request and shall perform any additional testing requested.

1.7 SEQUENCING AND SCHEDULING

A. General: Prior to the start of Work, prepare a detailed schedule of the work for coordination with other trades.

B. Schedule the installation of Topsoil Mixes after the area is no longer required for use by other trades and work. Schedule work to avoid compaction by later work and other trades.

C. Schedule all utility installations prior to beginning work in this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Approvals: Do not mix or deliver Topsoil to the site until all products testing samples have been approved by the Commissioner.

B. Weather: Do not mix, deliver or place or grade soils in frozen, wet, muddy or overly dry conditions.

C. Packaged Materials: Deliver packaged materials to the location where soils are to be mixed, in unopened bags or containers, each clearly bearing the name, guarantee, and trademark of the producer, material composition, manufacturers' certified analysis, and the weight of the material. Store and handle packaged materials in strict compliance with manufacturer's instructions and recommendations. Protect all materials from weather, damage, injury and theft. Retain empty packages for inspection.

D. Stockpiling: Topsoil, or amendment materials, stored on site temporarily in stockpiles prior to placement shall be protected from contaminants and erosion. Soil materials shall be covered with a pervious, needle-punched, geotextile tarpaulin until time of actual use. All stockpiled materials shall be placed on tarpaulin, heavy polyethylene sheeting or other suitable barrier to protect paving surfaces from staining or soiling by stockpiled materials.

1. Topsoil should be handled only when the moisture content is more than the point where the soil within the soil stockpile appears dry and soil peds become hard.

E. Soil mixing must take place offsite by an experienced soil-blending supplier.

F. Bulk Material: Coordinate delivery and storage with the City of New York and confine materials to neat piles in areas acceptable to the City of New York.

1.9 PROJECT CONDITIONS

A. Surface and Subsurface Conditions: It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to report any circumstances that will negatively impact soil drainage, soil settlement or other installation requirements. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Platforms and Structures: Perform work in a manner, which will avoid damage to marine structures, sea walls, platforms, decks, and other substructures.

C. Waterproofing: Perform work in a manner, which will avoid damage to planter waterproofing membrane, protection board or other structural sealing materials.

D. Construction Sequencing: Install all soils at the point in the project sequencing that the soil can be adequately protected from other work at the site.

E. Coordination: Coordinate work with that of other trade affecting or affected by work of this Section and cooperate to assure the steady progress of work.

F. Environmental Requirements:

1. Perform both off-site and on-site soil work only during suitable weather conditions. Do not work soil or subsoil when frozen, excessively wet, excessively dry, or in otherwise unsatisfactory condition. Do not work soil when moisture is so great that soil will "pump" under compacting force, nor when it is so dry that dust will form in the air or that clods or peds will not break readily.

2. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and placement.

3. Do not apply chemicals if wind conditions will cause hazardous drift to people or property.

4. Hazardous Materials- Do not provide or utilize materials that contain asbestos, PBC or other hazardous materials.

G. Safety: The Contactor shall be responsible for pedestrian and vehicular safety and control all movement within and around the work site. Provide the necessary barriers, warning devices and ground personnel needed to give safety, warning and protection to persons and vehicular traffic within the area of work including the contractor's equipment and temporary storage within the public right of way.

H. Damage: During site preparation, soil installation and protection, the Contractor shall be responsible for all damage to existing features above and below ground incurred as a result of work operations. Repairs and/or replacements shall be made to the satisfaction of the Commissioner.

I. Protection of Work: Protect all installed material for compaction, contamination and erosion. Install fences; utilize mulch, mats and geofabrics over the surface of the soil as required. In the event that any soil becomes compacted, contaminated or eroded, repair the damage using procedures required by the Commissioner.

1.10 WORKING AROUND UTILITIES

A. Carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

B. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

PART 2 PRODUCTS

2.1 AMMENDED EXISTING TOPSOIL

A. Base Soil Material shall be Harvested Soil from the site either in situ or stockpiled. If insufficient quantities of approved Base Soil Material exist on the Project Site, Base Soil material shall be Imported Harvested Soil from an off-site local source as approved the Commissioner. Base Soil Material from off-site shall follow the same testing procedures for acceptance as on-site material.

1. Soil acceptance criteria for soil harvesting:

a. General: Harvested soil shall be free of roots, clods, stones larger than 1-inch in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, hazardous material, brush and other litter. It shall not be infested with nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.

b. Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

c. Gradation limits: soil shall be a sandy loam or loam. The definition of soil texture shall be the USDA classification scheme. Gravel over 1/2-inch in diameter shall be less than 10% by weight.

d. Permeability Rate: Hydraulic conductivity rate shall be not less than one inch per hour nor more than 20 inches per hour when tested in accordance with the USDA Handbook Number 60, method 34b or other approved methods.

e. Fertility: The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate/DTPA Extraction parts per million (mg/kilogram) dry weight basis	
phosphorus	2 - 40
potassium	40 - 220
iron	2 - 35
manganese	0.3 – 6
zinc	0.6 - 8
copper	0.1 - 5
boron	0.2 - 1
magnesium	50 - 150

sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 30

f. Harvested soil may need to be amended and conditioned to optimize plant growth.

g. Acidity: The soil pH range measured in the saturation extract (Method 21a, USDA Handbook Number 60) shall be 6.0 - 7.9.

h. Salinity: The salinity range measured in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 0.5 - 2.5 millimho/cm.

i. Chloride: The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/l (parts per million).

j. Boron: The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/l (parts per million).

k. Sodium Adsorption Ratio (SAR): The maximum SAR shall be 3 measured per Method 20b, USDA Handbook Number 60.

l. Aluminum: Available aluminum measured with the Ammonium Bicarbonate/DTPA Extraction shall be less than 5 parts per million.

m. Soil Organic Matter Content: Sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter.

n. Heavy Metals: The maximum permissible elemental concentration in the soil shall not exceed the following concentrations.

Ammonium Bicarbonate/DTPA Extraction parts per million (mg/kilogram) dry weight basis	
arsenic	1
cadmium	1
chromium	10
cobalt	2
lead	30
mercury	1
nickel	5
selinium	3
Silver	0.5
vanadium	3

o. If the soil pH is between 6 and 7, the maximum permissble elemental concentration shall be reduced 50%. If the soil pH is less tha 6.0, the maximum permissible elemental concentration shall be reduced 75%. No more than three metals shall be present at 50% or more of the above values.

p. Phytotoxic constituent, herbicides, hydrocarbons etc.: Germination and growth of monocots and dicots shall not be restricted more than 10%. Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 0.5 mg/kg dry soil measured per EPA Methods No. 8020.

2. Soil acceptance criteria for amended soil:

a. The amended soil will be accepted if it complies with the following requirements. The soil will need to be leached if the concentration of boron exceeds 1 part per million, if the alkalinity is substantially over 8.0 or if the salinity exceeds 2.5 millimho/cm.

b. Fertility: The range of the essential elemental concentration of amended soil shall be as follows.

Ammonium Bicarbonate/DTPA Extraction parts per million (mg/kilogram) dry weight basis	
phosphorus	10 - 40
potassium	100 - 220
iron	5 - 35
manganese	0.6 - 6
zinc	1 - 8
copper	0.3 - 5
boron	0.2 - 1
magnesium	50 - 150
sodium	0 - 100
sulfur	25 - 500
molybdenum	0.1 - 30

a. Soil Organic Matter Content: About 3% to 5% - sufficient soil organic matter shall be present to impart good physical soil properties but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition of organic matter.

2.2 IMPORTED TOPSOIL

A. Fertile, friable, loamy soil, containing 1.4 to 5 percent by weight organic matter; less than 10% total volume of any combination of subsoil, refuse, roots larger than 1" in diameter, heavy or stiff clay, stones larger than 2 inch in diameter, sticks, brush, or litter. Topsoil shall not contain any substances deleterious to plant growth. Topsoil shall suitable for the germination of seeds and the support of vegetative growth. Topsoil shall not contain weed seeds in quantities that cause noticeable weed infestations in the final planting beds.

B. The pH value shall be between 6.0 and 7.0.

C. Topsoil shall be a harvested soil from fields or development sites. The organic content and particle size distribution shall be the result of natural soil formation. Soils where

sand, composted organic matter or chemical additives has been added to the soil to meet the requirements of this specification section shall not be acceptable.

D. Soil Texture: USDA textural designation loam or sandy loam, with clay content between 15% and 25%. And a combined clay/silt content of between 45% and 65%.

E. Topsoil shall NOT have been screened through any screen smaller than 2" and shall retain soil peds or clods larger than 2 inches in diameter throughout the stockpile.

F. Provide two-gallon sample from each topsoil source with soil testing results. The sample shall be a mixture of the random samples taken around the source stockpile or field. The soil shall be delivered with soil peds intact that represent the size and quantity of expected peds in the soil

2.3 COMPOSTED ORGANIC MATTER

A. Organic blended material composted for a minimum of 9 months and sufficiently to break down all woody fibers, seeds and leaf structures, free of toxic and non-organic matter. Source material shall be primarily branches and other yard waste designed to produce compost high in fungal material. Organic Matter shall be commercially prepared compost and meet US Compost Council STA/TMECC criteria or equal for stable, Composted Organic Matter intended for Planting Soil amendment Compost made from primarily green leaf yard waste shall not be acceptable.

B. Product Parameters:

1. pH 5.5 – 7.5
2. Soluable Salt Concentration (electrical conductivity) Maximum 10dS/m (mmhos/cm)
3. Moisture Content %, wet weight basis 30 – 60
4. Organic Matter Content %, dry weight basis 30 – 65
5. Particle Size % passing a select mesh size, dry weight basis 98% pass through 3/4" screen or smaller
6. Stability Carbon Dioxide Evolution Rate mg CO2-C per g OM per day < 8
7. Physical Contaminants (inerts) %, dry weight basis <1
8. Chemical Contaminants mg/kg (ppm) Meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels
9. Biological Contaminants Select Pathogens Fecal Coliform Bacteria, or Salmonella, Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

C. Provide a 3 lb sample with manufacturer's literature and material certification that the product meets the requirements.

2.4 COMPOSTED PINE FINES

A. Organic blended material composted for a minimum of 9 months and sufficiently to break down all woody fibers, seeds and leaf structures, free of toxic and non-organic matter. Source material shall be primarily pine bark. Composte shall be commercially prepared compost and meet US Compost Council STA/TMECC criteria or equal for

stable, Composted Organic Matter intended for Planting Soil amendment. Compost made from primarily green yard waste shall not be acceptable.

B. Product Parameters:

1. pH 5.5 – 7.0
2. Soluable Salt Concentration (electrical conductivity) Maximum 10dS/m (mmhos/cm)
3. Moisture Content %, dry weight basis 30 – 60
4. Organic Matter Content %, dry weight basis 30 – 65
5. Particle Size % passing a selected mesh size, dry weight basis 98% through ¾" screen or smaller
6. Stability Contaminants (inert) %, dry weight basis < 1
7. Physical Contaminants (inerts) %, dry weight basis <1
8. Chemical Contaminants mg/kg (ppm) Meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 1 and 3 levels.
9. Biological Contaminants Select Pathogens Fecal Coliform Bacteria, or Salmonella, Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

C. Provide a 3 lb sample with manufacturer's literature and material certification that the product meets the requirements.

2.5 COARSE SAND

A. Coarse concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.8 and 3.2.

1. Sand shall be clean, sharp, natural sands free of limestone, shale and slate particles. Sand PH shall be lower than 7.0.
2. Provide the following particle size distribution:

Sieve	Percent Passing
3/8" (9.5mm)	100
No 4 (4.75mm)	95-100
No 8 (2.36mm)	80-100
No 16(1.18mm)	50-85
No30 (.60mm)	25-60
No50 (.30mm)	10-30
No100 (.15mm)	2-10

B. Provide a 3 lb sample with manufacturer's literature and material certification that the product meets the requirements.

2.6 CHEMICAL ADDITIVES

A. Chemicals materials designed to increase soil fertility. All material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the

material and meeting all environmental regulations. All products shall be freshly manufactured and dated for the season in which the products are to be used.

1. Fertilizer for planting shall be organic fertilizer. Fertilizer selections shall be based on the recommendations of the soil test. Submit manufacturers' product literature for approval.

PART 3 EXECUTION

3.1 SITE EXAMINATION

A. Examine the surface grades and soil conditions for any circumstances that might be detrimental to soil drainage, such as uneven sub grades and waterproofing that may hold or pond water, deposits of construction-related waste or soil contamination, storage of material or equipment, soil compaction or poor drainage. Confirm that all utility work and installation of planter drainage has been completed and tested. Examine the grading, verify all elevations. Confirm that all other work in the area of Topsoil Mix installation is completed. Notify the City of New York in writing of any unsatisfactory conditions.

B. Using survey instruments, the Contractor shall verify that subgrade has been prepared according to specification with regard to compaction, grade tolerances and is free of debris prior to beginning work.

C. The Contractor shall be responsible for all construction surveying required for the proper location of all work covered hereunder

3.2 SOIL SURVEY

A. Contractor shall pothole one hole per acre. Contractor shall take individual soil samples from the top 2 feet, between 2 and 4 feet and between 4 feet and the depth of the excavation at each pothole. Contractor shall mark each sample by location and depth. Contractor shall send one pound of each sample by zone and depth to the laboratory for testing and evaluation. Contractor shall take Soil Samples from locations identified by the Commissioner and Soil Scientist. Soil Samples shall be taken at least 30 days in advance of commencing earth moving and grading operations. Contractor shall allow sufficient time for performance of Soil Testing and Test Results which will identify areas of suitable soil for Soil Harvesting, Stockpiling and Reuse as Planting Topsoil.

3.3 SOIL HARVESTING

A. Harvest suitable soil as determined by the soil survey results. Soil harvesting needs to selective and limited to the better soil. The target soil is darker in color, is less dusty, is more friable and has lower compaction, probably contains roots, contains less rock and gravel, contains less debris, etc. Preliminary identification of Suitable Soil for Soil Harvesting will be made based on Soil Survey results.

B. Contractor shall Stockpile the apparently suitable soil based on evaluation by Soil Scientist of Initial soil testing. Place unsuitable soil in a separate location. Mark the apparently suitable soil and warn other trades to not place trash on the stockpile.

C. Generally, the stockpiles should not be higher than 6 feet. The stockpiles should be worked from the side – equipment should not be operated on the amended soil surface, especially after amending. Moist soils are more sensitive to damage than dry soil. Dry soil can be stockpiled higher, particularly if they are low in soil organic matter.

D. Take one sample per 100 cubic yard with a minimum of 10 samples from the suitable stockpile for additional soil testing by Soil Scientist to determine its properties and recommendations for amendments.

3.4 SOIL AMENDING

A. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

3.5 SOIL AMENDING DEPTHS

A. Unless otherwise specified in the drawings or directed by the Commissioner and Soil Scientist the depth of amended soil shall be as follows:

1. Shrub and Herbaceous Plantings: Amend to 18-inches depth for an area equal to future mature shrub drip line or for shared or mass planting areas amend entire planting area.

2. Turf Grass and Meadow Areas: Amend to 9-inches entire planting area.

3. Trees: Amend to depth of the rootballs for trees but not less than 30 inches to an area 35 inches beyond the rootball edge.

3.6 ENHANCED SOIL DRAINAGE

A. General Site Areas

1. Before amended soils are placed, rip the base soil 6 inches deep to avoid a sharp soil interface.

3.7 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the soil work.

B. Protect installed Topsoil Mix from compaction by other trades.

C. Assure that all sediment control required by the project documents is in place during the installation of Topsoil. Provide additional sediment control to retain Topsoil within the project limits as needed to keep sediment from migrating on to finished paving and wall surfaces.

D. Irrigation and site utility coordination: Site utility and electrical conduits, irrigation lines and heads encountered during the Topsoil installation process shall be noted and flagged. Protect these lines from damage during the installation of Topsoil.

1. Where feasible install site utility including site lighting and irrigation below the subgrade of the Planting Soil prior to the installation of Topsoil.

2. Assure that all conduits and risers are outside the limit of all tree and large shrub root balls.

3. When required to have utilities, electric or irrigation lines installed within the Topsoil, coordinate with the subcontractors to avoid compacting the Topsoil. All utility trenches shall be hand dug through the Topsoil. Trenches shall be backfilled with the specified Topsoil at the compaction levels specified in Section Soil Preparation.

4. When conflicts between any conduits and soil installation or plant installation are unavoidable, Utility, electrical and irrigation lines shall be traced to their nearest connection and their alignment relocated to avoid the conflict. The open end of the irrigation line shall be capped to prevent clogging. The site of a disconnected irrigation line shall be flagged after excavated soil has been backfilled.

3.8 GRADE AND ELEVATION CONTROL

A. Provide grade and elevation control during installation of Planting Soil. Utilize grade stakes, surveying equipments and other means and methods to assure that grades and contours conform to the grades indicated on the plans.

B. Maintain grade stakes until the grades have been viewed by the Commissioner.

3.9 TOPSOIL DESIGN

A. Prepare a minimum of (3) 2-gallon sample mixes for each soil type using topsoil taken from different areas of the approved topsoil source, to determine the ratio of mix components to be added to the Topsoil Soil. Submit samples for approval.

B. This specification is based on the assumption that the soil products to be provided are natural and will vary in quality from location to location and within each soil source, and that mixing of soil will result in variety within the mix. The contractor is expected to provide samples that represent the range of product quality to be provided.

C. The contractor shall submit mix designs with test results for evaluation. Multiple rounds of testing and evaluations may be required before an approved Topsoil can be determined. For each test mix, submit both representative samples of the material along with the test results to the Commissioner.

D. Given the variability of the natural products in these Topsoils, the contractor is advised to work with the Commissioner when evaluating products and mix ratios. Significant amounts of time and soil testing cost can be saved if product specific issues and approaches to developing soil blending mixes are discussed prior to and during the testing process.

E. Schedule the Topsoil testing phase such that all testing and mix design is completed a minimum of six weeks prior to the installation of Topsoil.

3.10 SITE PREPARATION

A. In areas not above structure, excavate to the proposed sub grade. Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not over excavate compacted sub grades of adjacent pavement or structures. Maintain a supporting 1:1 side slope of compacted subgrade material along the edges of all paving

and structures with the bottom of the paving or structure above the elevation of the excavated planting area.

B. In areas above concrete slabs or structures, assure that all drainage material, foam and geotextiles are installed and drains operational. Check foam fill elevations to assure that they are at the proper elevation to permit the specified Topsoil depths and finished grades.

C. Remove all construction debris and material including any temporary construction roads.

D. Confirm that the sub grade is at the proper elevation and compacted as required. Sub grade elevations shall slope approximately parallel to the finished grade and/or toward the subsurface drain lines as shown on the drawings.

E. Do not proceed with the installation of Topsoil, until all utility work in the area has been installed.

F. Do not begin Topsoil installation until all subsurface drainage, drain boards, filter cloth, irrigation main lines, lateral lines, and irrigation risers shown on the drawings are viewed and approved by the Commissioner.

G. Protect adjacent walls, walks and utilities from damage or staining by the soil. Use 1/2" plywood and or plastic sheeting as directed to cover existing concrete, metal and masonry work and other items as directed during the progress of the work.

1. At the end of each working day, clean up any soil or dirt spilled on any paved surface.

2. Any damage to the paving or architectural work shall be repaired at the contractor's expense.

3.11 PLACEMENT OF STOCKPILED OR IMPORTED PLANTING TOPSOIL MIXES

A. All equipment utilized to install Topsoil shall be wide track machines rated with a ground pressure of 4 PSI or less. All grading and soil delivery equipment shall have buckets equipped with teeth to scarify any soil that becomes compacted.

B. In areas of soil installation above existing subsoils, loosen the subgrade material prior to installing Topsoil.

1. Scarify and loosen the subsoil of the sub grade to a depth of 3-6" with the teeth of the loader bucket or other suitable device.

2. Immediately install the Topsoil. Protect the loosened area from traffic. DO NOT allow the loosened sub grade to become compacted.

3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Topsoil.

C. In soil areas above structural surfaces and waterproofed conditions, carefully install the initial layer of Topsoil not to exceed 12-18 inches in depth. Do not disturb foam fill, geotextile overlaps, secure and brace drainage risers, brace and protect electric lines and irrigation lines and other conduits installed above the Drainage layer. Assure that no conduits are in conflict with the locations of root ball areas of trees.

D. Install the remaining Topsoil in 12-18" lifts to the required depths.

1. Where two different types of planting soil are intended to be layered on top of one another, scarify the surface of the lower soil prior to adding the upper soil. Scarification is intended to create an uneven surface with small ridges and valleys created by the teeth of a loader bucket to break the soil interface between the two soils and increase drainage rates between the tow soil types.

E. Phase work such that equipment to deliver or grade soil or deliver or install large trees does not have to operate over previously installed Planting Soil. Where possible, place large trees first and fill Topsoil around the root ball.

F. Where travel over installed soil is unavoidable. Limit the paths of traffic to reduce the impact of compaction in the soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with the paragraph "Compaction Reduction" in the event that soil becomes over compacted.

G. The depths and grades shown on the drawings are the final grades after settlement and shrinkage of the organic material. The contractor shall install the Topsoil at a higher level to anticipate this reduction of Topsoil volume. A minimum settlement of approximately 10% of the soil depth is in lawn areas shall be installed 1" higher than the design grades. All grade increases are assumed to be as measured to be prior to the addition of any surface compost till layer or mulch.

3.12 TOPSOIL SOIL COMPACTION

A. Compact the Topsoil to the compaction rates indicated and using the methods approved for the soil mock up.

1. Achieve a soil density of between 75 and 82% of maximum dry density standard proctor.

2. Topsoil compaction shall be tested at each lift using a cone penetrometer calibrated to the mock up soil and its moisture level. The same penetrometer and moisture meter used for the testing of the mock up shall be used to test installed soil throughout the work.

3. Maintain at the site a cone penetrometer with pressure dial and a soil moisture meter on the site at all times to measure the compaction rates relative to the mock up soil compaction. The Commissioner may utilize this equipment to verify compaction rates.

B. Maintain moisture conditions within the Topsoil during installation to allow for satisfactory compaction. Suspend installation operations if the Topsoil becomes wet. Apply water if the soil is overly dry. Do not place Topsoil on wet or frozen sub grade.

C. Provide adequate equipment to achieve consistent and uniform compaction of the Topsoil. Use the smallest equipment that can reasonably perform the task of spreading and compaction.

3.13 COMPACTION REDUCTION

A. Any soil that becomes compacted to a density greater than the specified density or the density in the approved mock up shall be dug up and reinstalled.

B. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6" or greater below finished grade. This requirement includes compaction caused by other subcontractors after the Topsoil is installed and approved.

3.14 INSTALLATION OF CHEMICAL ADDITIVES

A. Following the installation of each soil type, apply chemical additives as recommended by the soil test, and appropriate to the soil type and specific plants to be installed.

B. Types, application rates and methods of application shall be approved by the Commissioner prior to any applications. Chemicals are to installed under Composted Organic Matter and tilled into the soil. In turf areas Planting Soil Mix #2B, till fertilizers into the soil prior to fine grading.

C. Approximately one month after any application of chemical additives, re-sample the soil and apply additional applications if the soil tests indicate further chemical applications would be beneficial. Make sufficient test to analyze each soil type and each plant association within that soil type.

3.15 FINE GRADING

A. The Commissioner shall view all rough grading prior to the installation of Composted Organic Matter, fine grading, planting, and mulching. The Contractor shall set set grade stakes for all landscape features for checking the finish grades.

B. Grade the finish surface of all planted areas to meet the grades shown on the drawings after the twelve-month settling period.

C. Utilize equipment with rakes or buckets with teeth for fine grading to keep surface rough. Do not use the bottom of a loader bucket such that the finished grade is smooth and slightly compressed. Equipment operating over the installed soil shall be the smallest equipment possible to reasonably complete the work. Obtain approval for any motorized equipment larger than a 30 HP garden tractor.

D. Adjust the finish grades to meet field conditions as directed.

E. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds . Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Commissioner in the event that conditions make it impossible to achieve positive drainage.

F. Provide smooth transitions between slopes of different gradients and direction. Modify the grade so that the finish grade is flush with all paving surfaces or as directed by the drawings.

G. Fill all dips and remove any bumps in the over all plane of the slope.

1. The tolerance for dips and bumps in shrub and ground cover planting areas shall be a 1" deviation from the plane in 10'.

H. Restore all grades after the installation of plants.

3.16 PLACEMENT OF MULCH

A. Place mulch as indicated on the Drawings.

3.17 ACCEPTANCE OF STANDARDS

A. The Commissioner will inspect the work upon the request of the Contractor. Request for inspection shall be received by the Construction Manager and Commissioner at least 10 days before the anticipated date of inspection.

3.18 CLEAN UP

A. During installation, keep pavements clean and work area in an orderly condition.

B. Keep the site free of garbage at all times. Immediately dispose of wrappings or waste materials associated with products necessary for the completion of the work.

C. All garbage shall be kept in a central collection container. Do not bury garbage in backfill.

D. Once installation is complete,remove any excess soil from pavements or other site structures.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil. Trash, and debris, and legally dispose of it off of the City of New York's property.

3.20 PROTECTION

A. The Contractor shall protect installed Topsoil from damage due to other soil installation, planting operations, operations by other Contractors or trespassers including contamination and over compaction of Planting Soil. Maintain protection during installation until acceptance. Utilize fencing and matting as required or directed. Treat, repair or replace damaged Topsoil immediately.

B. Loosen compacted Topsoil and replace Topsoil that has become contaminated as determined by the Commissioner. Planting Topsoil shall be loosened or replaced at no expense to the City of New York.

3.21 REPAIR OF SETTLED TOPSOIL

A. At the end twelve months after the date of substantial completion of the Topsoil installation work, inspect the site and restore any areas where the grades have settled beyond the elevations shown on the drawings by an amount greater than 5% of the soil depth.

1. In shrub planting areas where the settlement is 3" or less, remove the mulch, top dress the area with the specified Topsoil and re-mulch.

2. In all ground cover areas and shrub planting areas where the settlement is greater than 3" remove mulch and plants, add the specified Topsoil, re-plant and re-mulch.

END OF SECTION

SECTION 329300

EXTERIOR PLANTINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Furnishing and installing new trees, shrubs, and all other plant materials.
2. Furnishing and installing new seeded turf grass areas.
3. Site preparation, furnishing and installing seeded meadow areas.
4. Staking and guying of trees.
5. Furnishing and installing mulch.
6. Protection and Guarantee Service of all plant materials until Substantial Completion.
7. Guarantee period for all new plant materials for a period of 24 months.
8. Guarantee Service of plantings for 24 months after substantial completion.

B. Definitions:

1. Finish Grade: Elevation of finish surface of planting soil.
2. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
3. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
4. PLS (pure live seed) is the measure of germination and purity to rate the seed quality. The percentage is obtained by multiplying the germination by the percentage of purity and dividing by 100. This percentage is used to estimate the amount of seed in a given lot that will germinate.

1.3 RELATED SECTIONS

A. Project Specific Sustainability Requirements - Section 013010

B. Geosynthetic Soil Stabilization and Layer Separation – Section 313219

C. Earthwork – Section 312000

D. Planting Soil Mixes – Section 329113

E. Soil Mixes for Wetland Areas – Section 327500

F. Plantings for Wetland Areas – Section 327200

G. Vegetated Roofing System – Section 073360

1.4 REFERENCES

A. AAN – American Association of Nurserymen

B. ASNS – "American Standard for Nursery Stock," ANSI Z60.1 latest edition, published by the American Associate of Nurserymen, (AAN)

C. ISA – International Society of Arboriculture, Tree and Shrubs Transplanting Manual, Latest Edition

D. NNA – National Arborist Association, Standards

E. SPN – "Standardized Plant Names," latest edition, by the American Joint Committee on Horticultural Nomenclature

F. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendation or suggestion shall be deemed to be mandatory under this Contract.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to DDC General Conditions.

B. Qualifications: Installer, Contract Grow Nursery

C. Procurement Documentation: submit written documentation for plant procurement a maximum of 60 days after the Notice to Proceed.

1. Identify specifically by name and quantity the plant material that is available in the required quantities, and the plant material that will require to be contract grown.

2. Plants grown by contract shall require a one year period prior to the estimated planting date. Submit the dates expected for planting and the proposed date for the beginning of the procurement process when the deposit will be given to the nursery. The schedule shall account for the time required for the plants to grow to the required sizes, in addition to the time the nursery needs to acquire planter liners or other tools required to ensure plant availability.

3. Provide written documentation from nursery for the time that they estimate is required for the plants to grow enough to meet our required plant sizes. The nursery shall also provide any other time requirements (to acquire liners, etc.) in the plant procurement process.

4. The Commissioner to approve the contract-grow nursery and expected timetable for plant procurement and planting.

D. Product Data

1. Literature & certificates or photographs for each type of product indicated.

2. Label data substantiation that planting materials comply with specified requirements.

3. Submit certified analysis for each treatment, amendment, and fertilizer material specified and as used. Include guaranteed analysis and weight for packaged material.

4. Plant Photographs: Prior to tree tagging, provide nursery sources and photographs of actual plants to be used on the project, for review and approval by the Commissioner. Photographs shall be legible and clearly depict the plant specimen.

   a. Each image shall include a height reference, such as a measuring rod, clearly marked in six inch increments, indicating height and width of the plant, plant quality and growth habit.
   b. Each Image shall be: either 8" x 10" high quality color prints or color digital photos at minimum 300 dpi.
   c. Trees: if 12 trees or less are to be planted, two photographs of each tree, prior to tagging at the nursery source. If 13 or more trees to be planted, at least four representative photographs typical of each species.
   d. The approval of the submitted photograph by the Commissioner does not preclude the Commissioner's right to reject material while at the nursery or on site.

E. Tree staking request, in writing, not less than 30 days before trees are to be installed.

F. Submittal Schedule: indicating anticipated dates and locations for each type of planting. This schedule shall be submitted within 15 calendar days after Contract Notice to Proceed. Include in this schedule anticipated dates from commencement and sequencing of planting operations, including but not limited to contract grow period, selections and tagging, layouts and layout approval, placement of trees, shrubs and commencement of Guarantee Service period.

Sample Submission Schedule

Planting Area	Product/Plant	Contract grown	Procured	Man'f or Nursery	Photograph or Sample	Tagged or Approved	Site Delivery	Installation date
Name	Name		Date	Name	Yes/No	Date	Date	Date
NE Bed	Acer rubrum	yes	1/5/2012	Halka	Jpg file	3/1/12	3/15/12	3/15/12
NE Bed	Mulch	N/A	2/1/12	LI Compost	Sample 2/15/12	2/28/12	3/16/12	3/17/12

G. Samples: for approval by Commissioner.

1. Mulch: Submittal of 3 pound bag of material, provider product data.

H. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for Meadow Mixes, and Turf Mixes identifying source, including name and telephone number of supplier.

I. Guarantee Service: Prior to Substantial Completion, Contractor to provide written schedule of proposed guarantee service operations. Schedule shall be in the form of a list of each guarantee service operation including dates indicating when each guarantee service task will be performed and the frequency of occurrence.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Submit a Statement of Qualifications for the Landscape Contractor. Qualifications shall show experience in the installation of landscape work of a similar type, design, scale, and with a record of successful landscape establishment to this project within the last three years.

C. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on the Project Site during times landscaping is in progress.

D. Contract Grow Nursery: Nursery will have a record of providing large quantities of plants at the sizes required ready within an appropriate planting season.

E. Nursery Stock Standards: Provide quality, size, genus, species, and variety of trees indicated, complying with applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock".

1. Selection of plant material will be made by Commissioner (at Commissioner's discretion), who will tag plants at their place of growth before they are prepared for transplanting.

F. Measurements: Measure trees according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4 –inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree for height and spread; do not measure branches or roots tip to tip.

G. Applicable Laws: Meet requirements of applicable laws codes, and regulations required by authorities having jurisdiction over the Work.

H. The Contractor is liable for any property damages cause by planting operations. All areas and construction shall be returned to the City of New York, at the satisfaction of the City of New York, at no additional cost to the City of New York.

I. Plant Selection and Inspection

1. All plant material shall be subject to inspection and approval by the Commissioner at the place of growth and again upon delivery and prior to planting for conformity to specification requirements as to quality, size and variety. Such approval shall not impair the right of rejection due to damage suffered in handling, transportation and/or planting during delivery and installation.

2. Contract grow material will be procured with enough time previous to the installation date that the plant material is the size required.

3. Written requests for inspection of plant material, at the place of growth, shall be submitted to the Commissioner, not less than six weeks prior to scheduled dig date.

4. The Contractor shall coordinate all inspection, selection and tagging arrangements with the nursery, ensuring the Commissioner is allowed maximum time for viewing, inspection, selection and tagging. A minimum of six weeks, prior to the time that the plant materials are to be dug, shall be allowed for inspection, selection and tagging.

5. The Commissioner may refuse inspection if in his/her judgment a sufficient quantity of plants is not available for inspection.

6. The Contractor shall, at his own expense, supply the Commissioner with such labor and assistance as may be necessary in the handling of material for proper inspection.

7. The Commissioner may choose to tag each plant, or a representative sample, with their own tags. The Contractor is responsible for paying any upcharge for the Commissioner to attach his/her tag to the selected plant material.

   a. Field tags to be attached to the north side of the tree in the nursery, by the Commissioner.

8. Tagging of trees shall be as follows: for every - 10 trees planted, 1 additional tree shall be tagged assuring appropriate replacement for (a) trees damaged prior to transplanting, and (b) trees requiring replacement under terms of the guarantee. These additional trees shall be root pruned. The Contractor shall be responsible for coordinating the terms with the nursery.

   a. All trees are to be dug prior to leafing out in the spring or when plants have gone dormant in the fall. The following Fall hazard species are to be spring dug only:

Alnus varieties
Betula varieties
Carpinus varieties
Celtis varieties
Cercidiphyllum varieites
Cornus varieties
Crataegus varieties
Fagus varieties
Halesia varieties
Ilex opaca varieties
Koelreuteria paniculata
Larix varieties
Liquidambar varieties
Liriodendron varieties
Malus-in leaf
Nyssa sylvatica
Ostrya virginiana
Populus varieties
Prunus – all stone fruit
Pyrus varieties
Quercus – all oaks except Quercus palustris
Salix – weeping varieties
Syringa reticulata
Taxodium distichum
Tilia tomentosa varieties
Ulmus species
Viburnum lentago
Zelkova species

9. Notify the Commissioner in writing at least five (5) working days in advance of delivery of plants to the site.

   a. The Commissioner reserves the right to inspect and or reject plant materials upon delivery to the site.
   b. Rejected plants shall be removed immediately from the site. All replacement plants shall be subject to the same requirements as the original material.
   c. Any plant that has the following characteristics shall be cause for rejection:

      1). TREES:
         (a). Has a canopy with 25% or more dead limbs.

(b). Has dead limbs, that when removed, will result in the loss of 25% or more of the structure and form of the canopy of the tree.

(c). If the species that has a characteristic dominant central leader, and if the lead is dead, when removed the tree will not have a form consisten with the species.

(d). Any tree that has open wounds (not completely healed over) that penetrates the bark to the wood on the trunks or major limbs, where the removal would result in the loss of 30% or more of the structure and form of the tree.

(e). Trees will be rejected if they show signs of damage, crooked or multiple leaders, tight vertical branches where bark is squeezed between two branches or between brank and trunk ("included bark") crossing trunks, cut-off limbs more than ¾" in diameter, or with stem girdling roots, unless otherwise noted.

(f). Plants with cracked or broken rootballs will not be accepted.

(g). Only natural burlap fabric shall be acceptable for balling. Plastic and other non-biodegrable fabrics will not be accepted.

2). SHRUBS

(a). Have 25% or more dead branches.

(b). Any dead limbs or portions, that when removed, will result in the loss of 25% or more of the structure and form of the shrub.

(c). If any dead or diseased branches, when removed the shrub will not have a form consistent with the species.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

C. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and storage at the site.

1. All packaged products shall be stored, handled and applied in strict accordance with manufacturer's instructions.

D. Stockpiling: Soil, mulch, or amendment materials, stored on site temporarily in stockpiles prior to placement shall be protected from intrusion of contaminants and erosion. All stockpiled materials shall be placed on tarpaulin, heavy polyethylene sheeting or other suitable barrier to protect paving surfaces from staining or soiling by stockpiled materials. No materials shall be stockpiled under the dripline of any existing or new tree. Coordinate with soil specifications and other Work.

E. Trees and Shrubs

1. Deliver freshly dug trees and shrubs. All trees shall be balled and burlapped stock (B&B), with a compact natural ball of earth, firmly wrapped and tied in burlap fabric Rootball and or containers shall correspond to AAN standards for the appropriate tree caliper or shrub height/spread. All shrubs shall be well branched to the ground. Trees shall have well branched top and fibrous root systems. Do not prune trees before installation, except as approved by Commissioner. Protect bark, branches, and root systems from sun-scald, drying, sweating, whipping, and other handling and tying damage. Do not bend trees in such a manner as to destroy natural shape. Provide protective covering during delivery.

   a. If deciduous trees are moved and delivered when in full-leaf, spray with an approved anti-desiccant per manufacturer's recommendations at the nursery no sooner than 48 hours prior to digging and again two (2) weeks after transplanting. Spraying should take place in the early morning hours with foliage. It is the responsibility of the Contractor to decide if anti-dessicant shall be applied to the tree before delivery.

   b. Do not drop trees or shrubs during delivery. Evidence of a damaged root-ball or container shall be cause for rejection.

2. Deliver trees and shrubs after preparations for planting have been completed and install immediately. If planting is delayed for more than 6 hours after delivery, set planting materials in shade, protect from weather and damage, and keep roots moist. Do not deliver more trees than can be planted in one day. It is not permissible to retain unplanted trees on-site overnight.

3. Water as often as necessary to maintain root systems in a moist condition. Do not allow trees or shrubs to wilt or show signs of stress from lack of water. Contractor shall use a moisture meter to verify adequate watering.

1.8 PRODUCT CONDITIONS

A. Field Measurements: Verify grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Immediately notify the Commissioner & the City of New York, in writing, if field conditions vary from the plans or drawings.

C. Utilities: Determine location of utilities including lighting, irrigation and drainage. Perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes by others until removal is mutually agreed upon by the Construction Manager and the Contractor.

1. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by the City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:

   a. Notify the Construction Manager no fewer than 5 days in advance of proposed interruption of each service or utility.

   b. Do not proceed with interruption of services or utilites without the Construction Manager's written permission.

D. Waterproofing and Sub Structures: Perform work in a manner, which will avoid damage to planter waterproofing membrane, adjacent waterproof membrane, protection board or other structural sealing materials.

E. Mechanical Lifting: The Contractor shall be responsible for lifting plant material, planting soils and other required material to planter areas for planting through exterior means or lifts as approved by the City of New York and the Commissioner.

F. Safety: The Construction Manager and Contractor shall be responsible for pedestrian and vehicular safety and control within the work site. The Contractor shall provide the necessary warning devices and ground personnel needed to provide safety, warning and protection to persons and vehicular traffic within the area.

1.9 SEQUENCING AND SCHEDULING

A. Preparation: The meadow planting has extensive site preparation to eliminate the weed population. See paragraph 3.7 herein for more information.

B. Planting Schedule and Environmental Requirements: Plant only within the following dates, weather permitting. Do not plant when the ground is frozen, excessively wet, or the soil is otherwise in an unsatisfactory condition for planting:

1. The spring planting season for trees and shrubs shall be:
   Deciduous materials from March 1st through May 1st.
   Evergreen materials from April 1st to May 15th.
   Or as approved by Commissioner

2. The fall planting season for trees and shrubs shall be:
   Deciduous materials from October 15th through December 15th.
   Evergreen materials from September 1st through October 15th.
   Or as approved by Commissioner

3. Turf seeding shall be carried out only during the following dates:
   Spring: April 1-June 1
   Fall: Sept 1-Oct 15

4. Meadow seeding shall be carried out only during the following dates:
   Preferred Season For Meadow Seeding: Spring April 1-June 1
   Alternative Season For Meadow Seeding: Fall Sept 1-Oct 15

Seeding shall be in moderately dry to moist soil, at such times when wind does not exceed five miles per hour.
In the event that seeding cannot proceed during the specified periods, areas shall be temporarily seeded with Annual Rye Grass to prevent erosion.

5. There will be no exceptions to the planting seasons, except for extreme weather conditions or as directed by the Commissioner.
6. Prior to leafing out in spring, fall hazard species shall be dug during the spring season only. (Refer to Section – Quality Assurance)

C. Notify the Commissioner at least seven (7) days in advance of all planting installation activities.

1.10 SUBSTANTIAL COMPLETION

A. Contractor shall submit a written request to the Commissioner for a formal inspection of the planting work for Substantial Completion.

B. At the time of inspection all plant material must be alive, healthy, installed as specified, and show positive signs of strong vigorous growth to be accepted.

C. All plant material shall be free of disease and pests. All plant material shall be free of broken or damaged limbs & branches.

D. If plants are dead, dying, unhealthy, not located as per the Contract Documents or approved location of the Commissioner, or if workmanship is unacceptable, written notice will be given to the Contractor in the form of a punch list which itemizes all remedial work required to obtain Substantial Completion.

E. This work may include plant replacement or guarantee service and must be carried out prior to issuance of the Certificate of Substantial Completion.

F. Coordinate Substantial Completion with irrigation work.

1.11 GUARANTEE

A. Warrant all planting materials, for the guarantee period indicated in Part 1, Section 1.2 herein, against defects including death and unsatisfactory growth, except for defects resulting from incidents that are beyond Contractor's control.

1. At the end of the guarantee period, plant materials shall be healthy, vigorous, and free of pests and disease. Plant materials shall be free of dead and dying branches and branch tips and shall bear foliage of normal density, size, and color for the species.
2. During the guarantee period, the contractor will maintain all plant materials as specified herein, and as noted in the approved guarantee service schedule, and will replace, at no additional cost to the City of New York, any and all plant material which has died or which is, in the opinion of the Commissioner, in unhealthy or unsightly condition. The meadow will be replaced, including re-doing the initial site preparation, if it has been overtaken with weeds.

3. There will be no limit to the number of of times replacements are made of individual plants.
4. Guarantee all replaced material for a period of 24 months after the date of replacement.
5. Approximately one month prior to the expiration of the guarantee period, the Contractor shall arrange a site inspection by the Commissioner.
    a. At this time the Contractor will prepare a list of all remedial work required, including plant replacement or guarantee service, to be approved by Commissioner.
    b. This work shall be carried out before the end of the guarantee period, unless weather conditions cause delays, in which case such work shall be carried out as soon as is practical.
6. If replacement plantings are required, there will be a final inspection at the end of the guarantee period for the plant replacements, to be coordinated with Commissioner.
7. Prior to end of Guarantee period, the Contractor shall include the following remedial actions as a minimum:
    a. Remove all tree staking and support.
    b. Rake out any plant saucers, unless directed by Commissioner.
    c. All trees that are leaning shall be straightened.
    d. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season due to weather.
    e. Replace planting materials that are more than 25% dead or in an unhealthy condition at the end of the guarantee period.
    f. Replace trees having lost their central leader or exhibit crown dieback at the end of the guarantee period.
    g. Replace plants with previously tagged specimens.
    h. Replacement plant materials shall closely match adjacent specimens of the same species and subject to the all requirements in this Specification. All areas damaged or soiled by replacement planting operations are to be fully restored to their original condition at no additional cost to the City of New York.
    i. There shall be no limit of replacement of each plant material, in the case of failure during the guarantee period.
    j. If settlement has occurred, reset the grades in the planting areas to the final grades shown on the grading plans of the Contract Documents
8. At the end of the guarantee period the Contactor shall remove all tree wraps, ties, stakes, and guying wires from the trees and the site. Tree wraps should not be on the tree trunks during the active growing season. The guarantee shall expire only when all requirements of the section have been met.
9. All of the materials and labor required for guarantee service and replacements during the guarantee period shall be included in the Contractor's bid price.

1.12 PLANT SERVICE

A. Guarantee service of all plant material shall begin immediately after plant installation, and shall continue for 24 months after the date of Substantial Completion.

B. Guarantee service shall include, but not limited to the following:

1. Maintain all plant material by pruning, cultivating, mulching, regular watering, removal of dead material, furnishing and applying such sprays as are necessary to keep plantings free of insects and disease, weeding, fertilizing, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Restore or replace damaged tree wrappings. Planting areas shall be kept free of weeds, grass, and other undesirable vegetative growth.

2. Coordinate with irrigation system installer for all adjustments to irrigation as required.

3. Defective work shall be corrected as soon as possible after it becomes apparent and the weather season permits. The Commissioner shall be the sole judge of the condition of the plants.

1.13 FINAL ACCEPTANCE

A. Following the completion of all remedial work and replacement plantings, the Contractor shall request the Commissioner in writing for a formal inspection of the landscape work for Final Acceptance. The request shall be received 10 calendar days before the anticipated date for final inspection.

1. If replacement plantings are required, Final Acceptance will be provisional upon a final inspection at the end of the Guarantee period for the plant replacements.

PART 2 PRODUCTS

2.1 PLANT MATERIALS

A. General: Furnish nursery-grown plant materials, including, but not limited to, trees, shrubs, vines, herbaceous plants, ornamental grasses, bulbs, corms, tubers & rhizomes, and groundcover plants, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasion, and disfigurement.

1. Grade: Provide plant material of sizes and grades conforming to ANSI Z60.1 for type of plants required. Plant materials of a larger size may be used if acceptable to the Commissioner, with proportionate increase in size of root-ball or container.

a. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise noted.

2. Species: All plant materials shall be true to species and cultivar specified. Certification of cultivars by supplying nursery must be supplied in writing to Commissioner.

3. Labels: Label at least 1 plant of each species, variety and size with a securely attached, waterproof tag bearing legible designation of botanical and common name. Field Tags by the Commissioner shall not be removed until so directed by the Commissioner.

4. Branching Height: For Single-stem trees branching height shall be 7'-0" and not more than 1/2 tree height. Limbing up shall not deform natural form of the tree.

5. Multiple-Stem Trees: Multiple-stem trees with multiple basal or low branched stems, and well-balanced crown, of height and caliper indicated, conforming to ANSI Z60.1 for type of trees required. Unless specified otherwise multiple-stem trees shall have 3 to 5 stems minimum.

6. Depth of Planting: The depth of planting must be checked for all trees being tagged at the nursery. If the root/trunk flare is not visible, the root/trunk (the intersection of the trunk and the buttress roots) must be located. Any tree with significant adventitious root growth or evidence of girdling roots shall be subject to rejection by the Commissioner on a case by case basis. Any soil above the root/trunk flare shall be removed prior to digging. After the removal of any excess soil above the root/trunk flare, the tree shall be hand dug and drum laced.

7. Container Grown Material: Container grown vines and groundcover plants shall be nursery grown, conforming to ANSI Z60.1. Container stock shall have well developed fibrous roots, so that the root mass will retain its shape and hold together when removed from the container. Container plants shall not be root bound.

8. Sources: Unless otherwise specified all plant materials shall be from a well-established Northeast region grower or nursery from the following sources:

Atlantic Nurseries
Dix Hills, NY
(631) 586-6242

Halka Nursery
Millstone Township, NJ
(732) 462-8450

Bissett Nurseries
Holtsville, NY
(631) 289-3500

Hardscrabble Nursery
North Salem, NY
(914) 669-5633

Or approved equal

B. Plant Materials: See Planting Schedule on Contract Drawings, unless otherwise specified.

1. Plants larger than specified may be used only if approved by the Commissioner. Use of such plants shall not increase the contract price. If larger plants are approved, the root ball shall be increased in proportion to the size of the plant. Contractor shall verify that size of root ball will fit in prepared planting pits.

2.2 SEED MIXES

A. SEED: TURF AREAS

1. Turf Type 1 – Low Rough Turf –clipped to 2" height
   Seed purity to be 98% with 85% germination, and maximum 0.25% weed seed (No noxious weeds)
   30% Tall Fescue Grande 4
   30% Tall Fescue SR8650
   30% Tall Fescue Trophy XRE
   10% Ryegrass – Champion GQ Seed Blend
   Seeding rate: 250 pounds per acre

2. Turf Type 2 – Rough Turf – mowed seasonally, 4" height max
   Seed purity to be 98% with 85% germination, and maximum 0.25% weed seed (No noxious weeds)
   60% Reliant Hard Fescue
   20% Little Blue Stem
   10% Jamestown II Chewings Fescue
   10% Red Fescue
   Seeding Rate 200 pounds per acre

B. SEED: MEADOW AREAS

1. TALL MEADOW SUN SEED MIX
   Seed to be fresh recleaned seed of the latest crop.
   Seed purity to be 98% with 95% germination, and no weed seed.
   Seed weight to be based upon Pure Live Seed (100% pure germinable seed)

15%	Agrostis perennenas	Autumn Bentgrass' Albany Pine Bush
4%	Asclepias tuberosa	Butterfly Milkweed
10%	Chamaecrista fasciculata	Partridge Pea
10%	Elymus virginicus	Virginia Wild Rye
1%	Eupatorium purpureum	Purple Node Joe-Pye Weed
2%	Monarda punctata	Spotted Bee Balm
10%	Panicum clandestinum	Deer Tongue 'Tioga'
15%	Panicum virgatum	Shelter Switch Grass 'Shawnee'
8%	Rudbeckia hirta	Black-Eyed Susan
15%	Schizachyrium scoparium	Little Bluestem 'Camper'
5%	Sorghastrum nutans	Indian Grass
5%	Tridens flavus	Purple Top

   Seeding rate: 15 lbs per acre

2. TALL MEADOW SHADE SEED MIX

Seed to be fresh recleaned seed of the latest crop.

Seed purity to be 98% with 95% germination, and no weed seed.

Seed weight to be based upon Pure Live Seed (100% pure germinable seed)

2%	Agrostis perennenas 'apb'	Autumn Bentgrass' Albany Pine Bush
2%	Anemone virginiana	Thimbleweed
3%	Aster macrophyllus	Big Leaf Aster
7%	Chaemcrista fasciculata	Partridge Pea
25%	Elymus hystrix	Bottlebrush Grass
25%	Elymus virginicus	Virginia Wild Rye
3%	Monarda fistulosa	Wild Bergamot
20%	Panicum clandestinum 'tioga'	Deer Tongue 'Tioga'
6%	Penstemon digitalis	Tall White Beard Tongue
3%	Solidago bicolor	Stiff White Goldenrod
1%	Vernonia noveboracensis	New York ironweed
3%	Zizia aurea	Golden Alexanders

Seeding rate: 15 lbs per acre

3. WILDFLOWER OVERSEED MIX

Seed to be fresh recleaned seed of the latest crop.

Seed purity to be 98% with 95% germination, and no weed seed.

Seed weight to be based upon Pure Live Seed (100% pure germinable seed)

50%	Coreopsis lancelata	Lanceleaf Coreopsis
50%	Leucanthemum vulgare	Oxeye Daisy

4. LOW SUN/SHADE MEADOW

Seed to be fresh recleaned seed of the latest crop.

Seed purity to be 98% with 95% germination, and no weed seed.

Seed weight to be based upon Pure Live Seed (100% pure germinable seed)

1%	Aster novae-angliae, PA Ecotype	New England Aster
15%	Bouteloua curtipendula	Side Oats
1%	Coreopsis tripteris, PA Ecotype	Tall Coreopsis
4%	Echinacea purpurea	Purple Coneflower
10%	Eragrostis curvula	Lovegrass
20%	Festuca ovina var. duriuscula	Hard Fescue
20%	Festuca ovina var. glauca	Blue Fescue
1%	Liatris spicata, PA Ecotype	Blazing Star Gayfeather
2%	Penesemon digitalis, PA Ecotype	Tall White Beard Tongue
4%	Rudbeckia hirta, NC Ecotype	Black-Eyed Susan

20%	Schizachyrium scoparium	Little Bluestem 'Camper'
2%	Solidago juncea, PA Ecotype	Early Goldenrod

5. WET MEADOW

Seed to be fresh recleaned seed of the latest crop.

Seed purity to be 98% with 95% germination, and no weed seed.

Seed weight to be based upon Pure Live Seed (100% pure germinable seed)

10%	Carex lurida, PA Ecotype	Lurid Sedge
15%	Carex vulpinoidea, PA Ecotype	Fox Sedge
25%	Elymus virginicus	Virginia wild rye
5%	Eupatorium maculatum, PA Ecotype	Spotted Joe Pyeweed
10%	Juncus effusus, PA Ecotype	Soft Rush
25%	Panicum rigidulum, PA Ecotype	Red Top Panicgrass
10%	Scirpus cyperinus, PA Ecotype	Woolgrass

C. Seed Sources:

1. Pennington Seed
800 John Quincy Adams Road
Taunton, MA 02730
Tel: 508-884-5443
Contact: Joe Conlon
Tel: 410-274-8759

2. East Coast Sod & Seed
596 Pointer Auburn Rd
Pilesgrove, NJ 08098
Tel. 609 760 4099
Contact: Kevin Driscoll

3. All Pro Horticulture Inc.
721 Main Street
Farmingdate, NY 11735
Tel. 516 903 4642
Contact: John Seib, Jr

Or

4. Approved Equal

D. SEED: TEMPORARY EROSION CONTROL

1. Annual Rye Grass. In the event the use of Annual Rye Grass is required to meet the seasonal planting limitation of these specifications or as described in the drawings, the Contractor shall supply clean fresh Annual Rye Grass seed from an approved supplier. Seed shall be warranted to germinate in 14 days or less and to be 98% pure. Seeding rate shall be 50 lbs per acre, or as recommended by supplier.

2.3 HYDROSEEDING / HYDROMULCHING

A. Seed: Grass seed mix for hydroseeding or hydromulching shall be fresh recleaned seed of the latest crop.

B. Hydromulch; shall be a wood fiber product colored with a non-toxic water-soluble green dye. It shall contain no germination or growth inhibiting factors. Hydromulch shall be of such consistency as to allow the fiber to be evenly dispersed and suspended when agitated in water. Hydromulch shall be equal to that which is manufactured by Conwed Fibers, Buffalo Grove, IL and Weyerhauser Co., Tacoma, WA, or approved equal. The rate of application shall be one thousand five hundred and thirty pounds (1530 lbs.) per acre, including the seed at the specified rate per acre.

1 Wood Fiber Mulch Binder: Shall be semiporous film material capable of binding wood fiber mulch and see to the soil. Wood fiber mulch binder shall be equal to that which is manufactured by Grass Grower, Plainfield, NJ, Trade Name: Terra Jack, or approved equal. The rate of application shall be seventy (70) gallons per acre (for two step application).

C. Fertilizer: Organic low nitrogen fertilizer (5-10-10). The manufacturer shall be responsible to certify that the fertilizer shall not lower the soil pH

D. Dye: Use a biodegradable nontoxic coloring agent free from copper, mercury and arsenic.

2.4 MULCH

A. Provide organic 12 month old aged fine-shredded hardwood mulch, of uniform size and free from deleterious materials or any material detrimental to plant growth, and suitable as top dressing to trees.

B. Shredded Bark Mulch shall be a natural forest product composed of shredded bark or wood not exceeding three inches (3") in length and one inch (1") in width. Mulch shall be derived from tree material, not from wood waste or by-products like sawdust, shredded palettes, or other debris. Mulch shall be natural in color and not dyed. It shall be of a uniform grade with no additives or any other treatment. Mulch with leaves, twigs, and/or debris shall not be acceptable. The pH factor should range from 5.8 to 6.20

C. Shredded bark mulch shall be applied to the surface of the beds and tree pit areas, as shown on the plans or Standard Details and as directed by the Comissioner. Mulch shall be applied to a uniform depth 2", and as indicated in drawings and shall be so distributed to create a smooth level cover over the exposed soil. Plants shall not be covered.

2.5 DRAINAGE MAT

A. Drainage mat is three-dimensional material which will direct water runoff beneath a substrate toward a drainage structure.

B. A composite drainage system of a three-dimensional "dimple" type polyethylene core and a woven filter fabric. The filter fabric is bonded to the top surface of the core, preventing intrusion of the fabric into the flow channels during backfilling. (Horizontal and vertical applications) Drainage mat & filter fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

C. Products: Install according to manufacture's recommendation:

1. Product: Hydrodrain 700 (can be used horizontally & vertically)
   Manufacturer: American Hydrotech, Inc.
   303 E. Ohio Street
   Chicago, IL
   Tel: (800) 877-6125
   Website: www.hydrotechusa.com

2. Product: Drain Away 50
   Manufacturer: Drainage Products, Inc.
   383 South Main Street
   Windsor Locks, CT 06096
   Tel: (860) 668-5108
   Website: www.drainaway.com

   Or approved equal

2.6 MYCHORRIZA FUNGI INNOCULANT

A. Mychorrizal fungi inoculant is a supplemental

B. Mychorrizal fungi inoculant shall be added to the top six to eight inches (6-8") of backfill soil in each planting pit and thoroughly mixed to distribute the inoculant.

C. Shall be applied by means of a three ounce (3 oz.) premeasured dry formulation packet.

D. Packets shall contain, as a minimum:

1. One thousand (1,000) live spores of:

   a. Vesicular-Arbuscular fungi, including:
      Entrephosphora columbiana

Glomus clarum
Glomus etunicatum
Glomus sp.

2. Seventeen million five hundred thousand (17,500,000) live spore of:
   a. Ectomycorrhizal fungi (Pisolithus tinctorius)
3. Biostimulant ingredients including Yucca schidigera extract.
4. Soluble sea kelp extract derived from Ascophylum nodosum.
5. Humic acids.
6. Acrylamide copolymer gel as a water absorbent medium.

E. The material shall be applied according to the following chart:

Container Size	Ounces per plant
1 gal	1
2 gal	2
3 gal	3
5 gal	3
7 gal	3
10 gal	3
15 gal	3

Rootball Diameter	Ounces per plant
20" B&B	6
24" B&B	9
30" B&B	9
36" B&B	12
40" B&B	12

F. Products: Install as according to manufacturer's recommendation or as directed by the Commissioner.

1. Product: Mycor Tree Saver Transplant
   Manufacturer: Plant Health Care, Inc.
   Pittsburgh, PA
   Website: www.planthealthcare.com

2. Product: Rhizanova Tree Transplant

Manufacturer: Becker Underwood, Inc.
Ames, IA
Website: www.beckerunderwood.com/en/home

Or approved equal.

2.7 PESTICIDES / HERBICIDES

A. General:

1. Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2. Approval required by the Commissioner if the pesticide/herbicide is not on the following approved list. Contractor shall prioritize using an alternative treatment prior to conventional pesticides / herbicides.

a. Pre-emergent Herbicides –
Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer. Apply in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
Acceptable to use:
1). Oxidiazon (pre-emergent)
2). Benefin (pre-emergent)
3). Trifluralin
4). Alternatives: Corn gluten Meal, or products with 2-phenethyl propionate, Clove Oil, Rosemary Oil

b. Broadleaf Herbicides
Acceptable to use:
1). Mecoprop, for spot treatments only. Submit specific product information for final approval.
2). Altnernatives: Iron Hedta for broadleaf weeds, or Fenoxaprop Ethyl for annual and perennial grass weeds.

c. Growth Regulating Herbicides
Acceptable to use:
1). Paclobutrazol

d. Non-Selective Herbicides
Acceptable to use:
1). Glyphosate, use Rodeo or equal registered for aquatic use. Submit for the Commissioner approval.

e. Fungicides
Acceptable to use (spot applications only):
1). Azoxystrobin
2). Propiconazole
3). Alternatives: Trichoderma Harzianum

f. Insecticides
Acceptable to use:
1). Deltamethrin
Alternatives: Steinernema Carpocapsae, Lambda-Cyhalothrin, Heterorhabditis, Bacteriophora, Cyfluthrin, Bacillys Popilliae, Spinosad

g. Or Approved Equal

2.8 TREE BRACING

A. Upright and Guy Stakes:

1. 3" diameter cedar stakes, rough-hewn, sound, new, free of knots, holes, cross grain, and other defects.

B. Tree Guying:

1. Product: Arbor Tie
flat woven polypropylene material,
¾" wide
900 lb break strength
Color: Green
Manufacturer: DeepRoot Green Infrastructure, LLc
San Francisco, CA 94111
Tel: (415) 781-9700
Tel: (800) 458-7668
Email: info@deeproot.com

Or approved equal.

C. See Sections herein for more information: Paragraph 3.3.H for appropriate reasons to have tree staking and guying, as well as installation instructions and Guarantee paragraph 1.11.7A for removal information.

2.9 PLANTING SOIL

A. Refer to Specification Section 329113-Soil Mixes

2.10 WATER

A. The Contractor shall be responsible for supplying all required water to the site at no additional cost to the City of New York. Clean fresh potable water suitable for human consumption, free of chemicals and impurities injurious to vegetation.

1. All work injured or damaged due to the lack of water, or the use of too much water, or contaminated water shall be the Contractor's responsibility to correct.

B. Source:

1. The Contractor must secure his own source of potable water if not available on site.

2. The Contractor shall use water trucks if necessary to import water to the site for regular watering of all plant materials.

3. The Contractor may obtain a hydrant permit from the Department of Environmental Protection, Bureau of Consumer Service, (718-595-6699). Permits are issued for a 30 day period, and the Contractor is responsible for keeping the permit current. The permits are available from each borough office.

C. Refer to Section –Irrigation

2.11 ACCESSORIES

A. Moisture Meter

1. Product: Precision Digital Soil Moisture Meter with Probe
   Model DSMM500
   Manufacturer: General Tools & Instruments
   New York, New York
   Tel: (212) 431-6499

2. Product: Digital Plus Moisture Meter
   Manufacturer: Ferry-Morse Seed Company
   Fulton, KY
   Tel: 1 (800)-626-3392

   Or approved equal

2.12 LANDSCAPE STEEL EDGING

A. Product: Steel Edging with Stakes
   1025-5 : 10' x ¼" x 5"
   Finish: Hot Dipped Galvanized
   Manufacturer: Col-Met
   Tel: (800)-829-8225
   Website: www.colmet.com

B. Product: Sure-Loc Steel Edging
16' x ¼" x 5" with 15" long stakes
Finish: Hot Dipped Galvanized
Manufacturer: Sure-Loc Edging Corporation
Tel: (800) 787-3562
Website: www.surelocedging.com

C. Or Approved Equal

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions where miscellaneous specialties are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

B. Examine areas to receive plantings for compliance with requirements and for conditions affecting performance of work in this Section.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Immediately notify the City of New York and the Commissioner in writing, of potential unsafe or hazardous soils.
3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
6. Verify planting soils are properly compacted. Remove and re-compact any soils which do not meet specification, until compaction rates are as specified.

C. Utilities and Structures.

1. The Contractor is responsible for determining the location of all utilities, by contacting the appropriate utility company prior to any planting activities.
2. Verify that the locations of lighting, drainage and irrigation utilities, structures and other underground items have been clearly marked and are in place, at the proper location, tested (excepted for final irrigation testing) and ready for use.
    a. Take proper precaution so as not to disturb or damage sub-surface elements.

b. Coordinate with other trades.

D. Examine the grading and verify that all elevations conform to the Contract Documents. Notify the City of New York and the Commissioner in writing of any discrepancies in the field.

1. Obtain written certification from the Construction Manager that the final rough grade has been set to plus or minus 0.10 inch prior to commencing tree pit execavation.

2. The Commissioner reserves the right to make grading adjustments in the field.

E. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by the Commissioner and replace with new planting soil.

3.2 PREPARATION

A. Site preparation for meadow seeding

1 Preparation for seeding must be carried out during the growing season to ensure that weeds are killed before wildflower seeding.

2. Place planting soil and perform grading of soils. Plant a cover crop of annual rye.

3. Weed removal

Preferred Method 1 – using cultivation

a. At the beginning of the planting season, when the soil is dry and workable, begin a regiment of lightly roto-tilling the soil to a depth of 3-4" every 2 weeks. Do not roto-till under the drip lines of existing trees, but instead remove all vegetation under the trees by hand every 2 weeks. This preparation must happen every 2 weeks for one full growing season in order to prevent weeds from recovering and regrowing.

b. If mugwort or phragmites are located on site, eradicate all mugwort and phragmites by a method approved by the Commissioner.

Alternate Method 2 – with herbicides

a. Apply "Roundup" (glyphosphate herbicide) three times throughout the growing season at 6-8 week intervals when plants are green and actively growing. (mid-spring, mid-summer, early fall). Apply Roundup in accordance with manufacturers' instructions, being very careful to avoid any overspray onto trees, shrubs or other plant materials. Do not apply when weather conditions are unsuitable (wind, impending rain etc.).

b. If perennial weeds are still present on the site after a full year of herbiciding, do not seed. Leave the soil undisturbed over winter, and apply one more herbicide treatment in late spring of the following year to kill any remaining weeds.

B. Prior to beginning Work under this Section, examine previously installed work and verify that such work is complete and to the point where planting installation may commence properly.

C. Protect structures, utilities, waterproofing, drainage structures, planter structures, pavements, and other facilities, and existing trees to remain from damage caused by planting operations.

D. Do not remove, sever or impact root structures of existing trees to remain in the preparation of sub-grade tree pit conditions. Conflicts with existing tree roots shall be brought to the attention of the Commissioner who may alter the required configuration to preserve or protect tree roots as they exist.

E. Do not alter the planting soils and soil horizon transitions between specified soil mixes already in place. If altered through planting operations return planting soil conditions to that indicated on Drawings.

F. Test drainage structures and verify working condition. Verify acceptable condition for protection boards and other waterproofing components. Immediately notify the City of New York and the Commissioner of any damage or other inoperable condition.

G. Verify planting soils are properly compacted. Remove and re-compact any soils which do not meet specification, until compaction rates are as specified.

H. Prior to planting, tree pits shall be dug to correct depth and width of root-ball, prior to installation, as per contract drawings.

I. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 TREE AND SHRUB PLANTING

A. Layout individual tree and shrub locations and areas for multiple plantings. Trees shall be staked prior to planting vines and groundcover plants in order to establish the planting structure of the site. Stake plant locations, adjust locations as necessary, when requested by the Commissioner. Secure the Commissioner approval prior to the start of planting work.

1. Notify the Commissioner one (1) week prior to the layout of the plants for the Commissioner's approval. The layout shall be organized to maximize the Commissioner's viewing time. Layout all individual trees and shrubs prior to the arranged viewing time. Locate the plants, still in its container or B&B, in the proposed planting location or place a labeled stake at the planting location. Secure the approval of the Commissioner prior to digging and installation. Make adjustments as required by the Commissioner.

B. Excavate pits, beds, and trenches with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root-ball and to assist in drainage away from the center. Do not further disturb the base.

C. Scarify area around the perimeter of the undisturbed tree ball pedestal and on the top 12" of undisturbed soil to create a transition layer.

D. The compacted setting beds under the tree root-ball shall be placed in six-inch lifts and hand tamped at each lift for stability in placement of root-ball and tree. Tree root-ball shall be firmly placed on compacted setting bed and established at correct location, elevation and in plumb upright condition. Partial soil settlement should be taken into consideration.Use temporary guy wires to secure tree in place as required during planting soil placement, to maintain proper setting location. Tree root-ball must be set at finish grade so that the original root/trunk flair is at the proper relationship to finished planting soil grade.

1. Before planting, verify that root flare is visible at the top of the root-ball according to ANSI Z60.1. If the root flare is not visible, remove the soil in a level manner from the root-ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that the root-ball still meets size requirements.
2. Unless otherwise specified or determined by the Commissioner, on site. Trees shall be oriented so their north side, as marked in the nursery, faces north.

E. All ropes and strings must be cut and removed. Non-biodegradable material must be removed, except for wire baskets. Burlap wrapping must be cut & folded back from the top one-quarter of the rootball. Do not remove burlap from lower sides or under rootball. Do not use planting stock if rootball is cracked or broken before or during planting operation.

1. The top twelve (12) inches of the wire baskets shall be cut vertically and folded down into the soil at the time of planting.
2. All twine and other materials to be entirely removed from the tree trunk.

F. Backfilling with planting soil may occur only when placement of trees and shrubs have been approved by the Commissioner. Do not make saucer indentations with soil, unless otherwise directed the Commissioner.

G. Backfill planting soils shall be placed in uniform six to eight inch lifts. Soil must be firmed at each lift interval by hand tamping as required to settle back fill and eliminate voids and air pockets. When pit is approximately 1/3 back-filled, water until soil is thoroughly settled. Repeat watering until no more is absorbed. Water again after placing second 1/3 level and again after placing final layer of backfill.

H. Staking and Guying:

1. Staking of trees, shall only be permitted in the event that site conditions or tree conditions are such that the tree is anticipated to be unstable. The Contractor shall submit, in writing, for approval of the Commissioner, a request to stabilize any tree. The submission shall include; the type and location of each tree, the reason why stabilization is requested and the stabilization method to be employed.
2. Provide staking per Drawings, or as approved by the Commissioner.
3. Contractor shall remove tree stakes & other supports at the end of the guarantee period.

3.4 MULCH PLACEMENT

A. Mulch top of rootballs and groundcover beds covering the entire planting area. Depth of mulch shall be as indicated in the Contract Documents, unless otherwise specified. Top of mulch shall be level.

B. Mulch shall not come in contract with any part of the trunk or root flare.

C. Do not over mulch. Excess mulch shall be removed from the site.

3.5 INITIAL PRUNING

A. Contractor shall prune trees as directed by the Commissioner and according to the Documents.

B. All pruning of limbs and roots must be performed by a qualified ISA-certified arborist as approved by the City of New York and the Commissioner.

C. Prune, think and shape trees according to standard horticultureal practice. Prune trees to retain required height and spread. Unless otherwise directed by the Commissioner, do not cut tree leaders; remove only injured or dead branches.

D. Pruning shall be done with sharp and clean tools. Cuts shall be made flush, leaving no stubs as per ANSI A300-1995.

E. No tree paint or sealant shall be permitted.

3.6 INSTALLATION OF MEADOW SEEDING

A The preferred season for meadow seeding is Spring.

1. Hand broadcast, distribute with a brillion seeder or a drop spreader and hydromulch. If Hydromulch is used, mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application. Use tackifier in slurry mix where slopes are greater than or equal to 3:1. All areas to be hydroseeded shall be thoroughly loosened to a depth of 6 inches and graded to true lines free from all unsightly variations, bumps, ridges or depressions. All sticks, stones, roots or other objectionable material shall be removed.

    a. Wash canister in which seed is mixed and distributed three times prior to adding seed to prevent contaminating desired seed mix and in between changing seed mix types.

3.7 HYDROSEEDING

A. Lawn seed shall be sown in the fall during the months of September or October or as directed by the Commissioner. Prior to seeding, the area to be seeded shall be disced to loosen top four inches (4") of soil. The disced area shall be fine tilled to open the soil and render it free of rocks, roots, topgrowth, or debris over two inches (2") in any direction. The chain method or another suitable and preapproved method of cultivation shall be employed to loosen, rough grade, and prepare the seedbed.

B. All seeding shall be performed in moderately dry to moist soil conditions at a time when the wind velocity does not exceed five miles per hour (5 mph). The application of seed, hydromulch, wood fiber binder, and fertilizer shall be by an approved Hydromulcher or Hydroseeder machine with an adequate capacity expediently and the ability to uniformly mix, pump and spray a uniform slurry of the hydroseeding ingredients.

C. All mixtures shall be constantly agitated from the time they are mixed until they are applied to the seedbed. All seed mixtures in aqueous agitation shall be applied with eight (8) hours after mixing, except for leguminous seed, which shall be applied within one hour after mixing. Seed mixtures not applied within these limits shall be discarded and the Contractor shall receive no payment for the materials. The application shall be a two (2) part procedure: ·

1. Apply seed, and twenty-five percent (25%) of the hydromulch.
2. Apply seventy-five percent (75%) of the hydromulch and wood fiber mulch binder, or an alternate method approved by the Commissioner.

D. The seed shall be applied uniformly on a firm, moist seedbed. The seed and fertilizer shall be mixed on site and the seeding shall be performed immediately and without interruption. The mixture shall be applied by means of a high pressure spray which shall be always directed upward so the suspended mixture shall fall like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in any way that might produce erosion or runoff.

E. Particular care shall be exercised to ensure that the application is made uniformly and at the prescribed rate, guarding against missed areas and overlaps. The rate of application may be checked by observing the degree of wetting of the ground or by distributing test sheets of paper or collecting containers over the area at intervals and observing the quality of material deposited. The spray method shall not be used during periods of high winds, which prohibit satisfactory spray patterns.

F. Staged Seeding Operations: In order to minimize erosion of areas where grading is complete, the Contractor shall stage the application of groundcover hydromulching to coincide with completed construction work. Inspection and acceptance shall be provided for areas in which approved growth is achieved

3.8 WATERING OF PLANTED AREAS

A. The Contractor shall provide all labor and arrange for all watering necessary to establish acceptable plant materials.

1. Begin watering immediately following installation. Closely monitor plant water intake and insure adequate water is provided to them at all times.
2. Watering shall continue throughout the contract period until the end of defined Guarantee Service Period.

3. During the first two weeks after planting, in the absence of adequate rainfall, watering shall be performed up to 3 times daily or as often as necessary and in sufficient quantities to maintain moist soil to a depth of at least two inches.

4. After the first two weeks, the Contractor shall water the plant bed to maintain adequate moisture in the upper two inches (2") of soil, necessary for the promotion of deep root growth.

5. Watering shall be done in a manner which will provide uniform coverage, prevent erosion due to application of excessive quantities over small areas, and prevent damage to the finished surface by the watering equipment. The Contractor shall furnish sufficient watering equipment to apply one (1) complete coverage to all planted areas in an eight (8) hour period.

6. Minimize excess watering/irrigation. Adjust irrigation controller or hand watering, as required, to provide the ideal amount of water to all plant materials.

3.9 CLEAN-UP AND PROTECTION

A. Keep pavements clean and adjacent work areas in an orderly condition, free of construction debris, tools, extra soil, mulch and accessories.

B. Do not stockpile or store equipment or material within plant beds, or within drip-lines of new or existing trees.

C. Protect landscaping from damage due to landscape operations, operations by other Contractors and trades and trespassers. Maintain protection during installation and Guarantee Service periods. Utilize temporary barriers as necessary and approved by the Commissioner.

D. Treat, repair or replace damaged work as directed.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris. Legally dispose of waste materials off the City of New York's property.

B. Do not bury waste or garbage in the back-fill or planting areas.

END OF SECTION 329300

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 329301

TREE PROTECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the miscellaneous specialties as shown on the drawings and/or specified herein, including but not necessarily limited to the following:

1. Under these items, before commencing any work on the site, the Contractor shall erect 'Temporary Tree Protection: Single Tree', 'Temporary Tree Protection: Single High Quality Specimen Tree' and/or 'Temporary Tree Protection: Groups of Trees' around existing trees in accordance with the plans, specifications and directions of the Engineer. Also, the branches of the existing trees shall be tied up, when directed, to prevent injury during work on the site.

2. Under these items, the Contractor shall protect existing tree roots with wood chips – 6" depth in accordance with the plans, specifications, and directions of the Commissioner.

3. Under these items, the Contractor shall protect existing tree roots with plywood or mats in accordance with the plans, specifications, and the direction of the Commissioner. Plywood sheets or ground surface protection mats shall be installed as a temporary protection for tree roots during construction operations and shall be removed from the site at the Contractors expense when work is complete.

1.3 RELATED SECTIONS

A.	Sustainability Requirements	- Section 013010
B.	Geosynthetic Soil Stabilization and Layer Separation	– Section 313219
C.	Earthwork	– Section 312000
D.	Planting Soil Mixes	– Section 329113
E.	Soil Mixes for Wetland Areas	– Section 327500
F.	Exterior Plantings	– Section 329300
G.	Plantings for Wetland Areas	– Section 327200

H. Vegetated Roofing System – Section 073360

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.5 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary.

PART 2 PRODUCTS

2.1 TEMPORARY TREE PROTECTION: SINGLE TREE

A. Tree Guard: Lumber shall be Yellow Pine, Douglas Fir or Spruce. Nails shall be galvanized. No paint will be required. All work shall be done in a neat and workmanlike manner to the satisfaction of the Commissioner.

B. Tree Wrap: Tree warp shall be snow fencing composed of commercially woven wood slats and wire.

C. Line Post/Stake: Line Post/Stake shall be 'Heavy Vinyl Guard Post', 'U' shaped, 13 guage, rustproofed stell, three (3' – 0") foot height, manufactured by Boundary Fence and Rail Systems, Richmond Hill, NY or approved equal. Color to be Black.

2.2 TEMPORARY TREE PROTECTION: SINGLE HIGH QUALITY SPECIMEN TREE; TEMPORARY TREE PROTECTION: GROUP OF TREES

A. Snow fence shall be 4'-0" in height, constructed of either wood or plastic, as described below.

1. Fabric: Shall be commercially woven wood slats and wire or **high-density polyethylene. Color to be bright orange.

2. Line Posts: Shall be two and one-half (2 ½) inch diameter steel stakes.

3. Tie Wire: For wood fence shall be aluminum or steel ties. For plastic shall be general-purpose heavy plastic ties.

2.3 PROTECTION OF EXISTING TREE ROOTS WITH WOOD CHIPS-6"DEPTH

A. Wood Chips: shall be clean chips free of any deleterious material such as ash or insecticide. Chips may be of any wood except wood wast generated from an Asian Longhorned beetle infestation or an Emerald Ash borer infestation. Wood chips produced on the site through authorized pruning and tree removal may also be used for

this work. Chips shall be derived from tree material, not from wood waste or by-products like sawdust, shredded palettes, or other debris.

1. Asian Longhorned Beetle Quarantine Zone Regulations: Due to current Federal, State, and New York City Department of Parks and Recreation policy, any wood waste that is tranported must be performed by a Sub/Contractor certified by the New York State Department of Agriculture and Markets to perform tree work within the Quarantine Zone. For additional information regarding NYC Department of Parks and Recreation procedures, see the NYC Departement of Parks and Recreation specifications, General Conditions, Special Provisions, Section C, Article 14 "Tree Work."

2.4 PROTECTION OF EXISTING TREE ROOTS WITH PLYWOOD OR MATS

A. Plywood: shall be new or gently used four (4) foot by eight (8) foot sheets with a minimum thickness of one-half (1/2") inch. CCA treated lumber is not acceptable for the Work. Hardware to fasten plywood sheets shall be corrosion resistant steel.

or

B. Ground Surface Protection Mats: shall be manufactured from high-density polyethylene (HPDE), one-half (1/2") inch thick minimum, measure approximately four (4) foot by eight (8) foot, be equipped with a lip on two sides that creates an overlapping joint with an adjoining mat to allow for effective load distribution between mats, have an interlocking mechanism consisting of multiple connection points uniformally spaced along the full length of the overlapping lips of adjacent mats with fixed locking pins, and a potential load bearing capacity of at least 60 tons dependent upon sub-surface properties. Mats shall be similar to "Dura-Deck" as manufactured by Signature Fencing & Flooring, NY, NY, or "AlturnaMATS" by Alturnamats, Inc. Titusville, PA or approved equal.

PART 3 EXECUTION

3.1 INSPECTION

A. The Contractor shall notify both the DDC Commissioner and the Director of Arboriculture and Horticulture Unit of the NYC Department of Parks and Recreation (Captial.Arb-Hort@parks.nyc.gov). a minimum of 48 hours in advance of any work on, or impacting, existing trees.

B. Examine the areas and conditions where miscellaneous specialties are to be installed and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

C. Coordinate as required with other trades to ensure proper and adequate provision in the work of those trades for interface with the work of this Section.

D. Install the work of this Section in strict accordance with the original design, the approved Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures.

3.2 INSTALLATION OF TEMPORARY TREE PROTECTION: SINGLE TREE

A. Rough sawn wood boards shall be carefully wrapped around the trunk of the tree, above the flare and secure with steel or aluminum tie wire, as directly by the Commissioner, the Director of Arboriculture and Horticulture Unit of the NYC Department of Parks and Recreation or the designated representative. Tree wrap shall be installed prior to the installation of the tree guards.

B. The temporary wooden tree guards shall be installed where shown on the contract drawings. Posts shall be installed at approximately eight feet on center, unless otherwise noted on the plans or directed by the Engineer. They shall be installed with line post/stakes securely attached with galvanized or stainless steel screws to the wooden posts and driven 18" into the ground, as directed by the Commissioner, the Director of Arboriculture and Horticulture Unit of the NYC Department of Parks and Recreation or the designated representative, without damage to existing trees. If any temporary wooden tree guards or wrap are damaged during the course of the work, they shall be immediately repaired, or replaced by a new temporary wooden tree guard or wrap at no additional expense.

C. Temporary wooden tree guards and wrap shall remain in place and not be moved or removed without written permission of the Commissioner, the Director of Arboriculture and Horticulture Unit of the NYC Department of Parks and Recreation or the designated representative unitl all work which might cause damage or defacement has been completed. Upon completion of the work, to the satisfaction of the Commissioner, the Contractor shall remove and dispose of all temporary wooden tree guards and wraps.

3.3 INSTALLATION OF TEMPORARY TREE PROTECTION: SINGLE HIGH QUALITY SPECIMEN TREE AND TEMPORARY TREE PROTECTION: GROUP OF TREES

A. The steel stakes shall be driven into the ground to a depth of two (2) feet. Fabric shall be secured to line stakes with three-sixteenth (3/16) inch aluminum or steel tie wire or plastic ties spaced eighteen (18) inches apart on posts. Line post spacing shall not exceed eight (8) feet on center.

1. The Contractor shall maintain the temporary tree protection during the life of this contract and shall repair or replace all members that are disturbed, damaged, destroyed or vandalized at no extra cost. Upon completion of the work, the fence shall be removed by the Contractor.

B. Relocation: At no extra cost to the City, the Engineer reserves the right to direct the Contractor to remove and reinstall snow fence within the Contract limit line. The Contractor may be asked to relocated the fence a maximum of three (3) times in excess of the initial installation.

1. The Contractor is also responsible for restoration of any lawn pavement disturbed by fence or in areas adjacent to fencing, after tremoval of fencing is completed. The cost of the restoration shall be included.

3.4 INSTALLATION OF EXISTING TREE ROOTS WITH WOOD CHIPS-6" DEPTH

A. Wood chips for temporary tree root protection during construction shall be applied by hand to the surface of the tree protection area as shown on the plans or as directed by the Engineer in consultation with a representative of the Arboriculture and Horticulture Unit of the New York City Department of Parks and Recreation and the Commissioner. Wood chips shall be applied to a uniform depth of six (6") inches over the entire area and shall be so distributed as to create a smooth level cover. The Arboriculture and Horticulture Unit of the New York City Department of Parks and Recreation and the Commissioner shall inspect the work and approve the work, as required to assure tree root protection.

B. Maintenance of six (6") inch depth: If any wood chips are dislocated or depleted during the course of the work, they shall be immediately replaced with new wood chips within 24 hours of the notification at no additional cost.

C. Removal: At the completion of the work of this contract, unless otherwise directed by the Commissioner, the Contractor shall remove the wood chips by hand. Wood Chips to protect existing roots shall remain in place and not be moved or removed without written permission of the Commissioner and/or the New York City Department of Parks and Recreation until all work which might cause soil compaction or root damage has been completed.

D. The Contractor may submit a written request to remove by machine to the Arboriculture and Horticulture Unit of the New York City Department of Parks and Recreation. No machine removal shall be allowed without prior approval and supervision by the Arboriculture and Horticulture Unit of the New York City Department of Parks and Recreation. If any trees are damaged during removal of wood chips, the provisions of the New York City Department of Parks and Recreation Specifications, Section C, Article 14 Remediation and Damage Assessment shall apply. Upon completion of the work, the wood chips shall be removed by the Contractor.

3.5 INSTALLATION OF PROTECTION OF EXISTING TREE ROOTS WITH PLYWOOD OR MATS

A. The Contractor shall place plywood sheets and/or ground surface protection mats in areas shown on the drawings and as directed by the Arboriculture and Horticulture Unit of the New York City Department of Parks. The Arboriculture and Horticulture Unit of the New York City Department of Parks and Recreation and the Commissioner shall inspect the work and approve the work as required to assure tree root protection. The Contractor shall sawcut and fasten plywood sheets if necessary to fit into tree root areas. The Contractor shall place and fasten ground surface protection mats throughout the tree root areas as shown on the tree protection plan. Plywood/Ground surface protection mats shall remain in place and not be moved or removed with the written permission granted by the Arboriculture and Horticulture Unit of the New York

City Department of Parks and Recreation until all work which might cause compaction or root damage has been completed.

B. If any plywood/ground surface protection mat is dislocated, damaged, or destroyed during the course of the work, it shall be immediately replaced by new or gently used plywood/ground surface protection mat within 48 hours of notification at no additional cost. All hardware shall be removed from the site when plywood/ground surface protection mat is relocated or removed. Plywood sheets/ground surface protection mats and all associated hardware shall be removed as necessary to facilitate construction and when they are no longer required on site as determined by the Construction Manager. If any trees are damaged during removal, the provisions of the New York City Department of Parks and Recreation Specifications of Section C, Article 14 Remediation and Damage Assessment shall apply. Plywood sheets/Ground surface protection mats shall be the property of the Contractor.

END OF SECTION

SECTION 330500

COMMON WORK RESULTS FOR UTILITIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, and services needed to constructing the on-site and off-site utilities and related structures and apparatus for sanitary sewer, electrical, gas, telephone as shown on the Contract Drawings or as directed by the Commissioner.

B. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Piped utility demolition.
4. Piping system common requirements.

C. Related Sections:

1. Section 333100 - Sanitary Utility Piping and Structures
2. Section 334100 - Storm Drainage System
3. Section 334600 - Sub Drainage

1.3 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.5 SUBMITTALS

A. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

    a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

    b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

    c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

    d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

    a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

    b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

    c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject

to the approval of theCommissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

PART 2 PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

2. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

3. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

4. Manufacturers:

a. Coast Rubber and Gasket, Inc
b. D&D Engineered Products
c. Grumen Manufacturing, Inc
d. Or Approved Equal

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

1. Manufacturers:

a. Coast Rubber and Gasket, Inc
b. D&D Engineered Products
c. Grumen Manufacturing, Inc
d. Or Approved Equal

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

PART 3 EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Section 024000 "Demolition of Existing Structures" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

1. Install piping to permit valve servicing.

2. Install piping at indicated slopes.

3. Install piping free of sags and bends.

4. Install fittings for changes in direction and branch connections. Select system components with pressure rating equal to or greater than system operating pressure.

5. Verify final equipment locations for roughing-in

6. Refer to equipment specifications in other Sections for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specify piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

F. Plastic Pressure Piping Gasket Joints: Join according to ASTM D 3139.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2" and smaller, adjacent to each valve and at final connection to each piece of equipment.

Install flanges, in piping NPS 2-1/2" and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.5 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

B. Locate pipe markers on exposed piping according to the following:

1. Locate pipe markers on exposed piping according to the following:

2. Near each valve and control device.

3. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.

4. At manholes and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

END OF SECTION 330500

This Page Intentionally Left Blank

SECTION 333100

SANITARY UTILITY PIPING AND STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. Section Includes:

1. Pipe and fittings.

2. Cleanouts.

3. Manholes.

1.3 ACTION SUBMITTALS

A. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet and to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of section of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by City of New York or others unless permitted under the following

conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify the Commissioner no fewer than two days in advance of proposed interruption of service.

2. Do not proceed with interruption of service without Commissioner's written permission.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

2.2 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work.

2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

3. Top-Loading Classification(s): Medium Duty.

4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.3 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

2. Diameter: 48 inches minimum unless otherwise indicated.

3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.

4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.

5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.

6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.

7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.

8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.

9. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.

10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."

2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

2.4 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earthwork."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of micro-tunneling.

F. Install gravity-flow, non-pressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent

unless otherwise indicated.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.

3. Install piping with 36-inch minimum cover.

4. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.

G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure, drainage piping according to the following:

1. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Form continuous concrete channels and benches between inlets and outlet.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 1" above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.

4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

A. Connect non-pressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.8 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.

2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 312000 "Earthwork".

3.9 IDENTIFICATION

A. Comply with requirements in Section 31200 "Earthwork" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.10 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Damage: Crushed, broken, cracked, or otherwise damaged piping.

c. Infiltration: Water leakage into piping.

d. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

   a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.

   b. Close openings in system and fill with water.

   c. Purge air and refill with water.

   d. Disconnect water supply.

   e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

7. Manholes: Perform hydraulic test according to ASTM C 969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.11 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with water.

END OF SECTION 333100

This Page Intentionally Left Blank

SECTION 334000

FLAP GATE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform excavation, backfill, trenching, compaction, and installing of gates on pipes or in drainage structures, as shown on the Contract Drawings or as directed by the Commissioner.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawing: Drawings showing the dimensions and details required to locate and install the component assemblies shall be submitted for the Commissioner's approval prior to fabrication.

C. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each

product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.4 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

B. Notify Commissioner no fewer than two days in advance of proposed interruption of service.

C. Do not proceed with interruption of service without Commissioner's written permission.

PART 2 PRODUCT

2.1 SEAT

A. The seat shall be flat back and shall be cast in one piece with a raised section around the perimeter of the waterway opening to mount the seating faces. The raised section shall provide a seating plane diverging top to bottom from the plane of the mounting flange to assist in positive closure of the cover. The seat shall be shaped to provide two bosses extended above the top of the waterway opening for mounting the pivot lugs. Pivot lug bosses shall be drilled and tapped for mounting studs. The back of the seat shall be machined to a plane and drilled to mate the anchor or stud layout. Gates attached to concrete shall be mounted on anchor bolts and grouted in place.

2.2 COVER

A. The cover shall be cast in one piece with necessary reinforcing ribs, a lifting eye for manual operation, and with bosses to provide a pivot point connection with the links. Bosses shall be designed to place the hinge pins in double shear when the gate is assembled.

2.3 SEATING FACES

A. A full-width, dovetail slot shall be machined around the perimeter of the cover and the seat. Corrosion-resistant dovetail seating faces shall be mounted in the slot and held securely without use of screws or other fasteners. The seating faces shall be machined to a plane with a minimum 63 micro-inch finish.

B. Flap gates subjected to mild slamming action shall have a rubber seating face on the seat. Rubber seating faces shall be mounted in a dovetail slot and held securely without use of pins or screws. The seating face on the cover shall be as specified in the previous section.

2.4 PIVOT LUGS

A. Each pivot lug shall be cast in one piece. Lugs shall have double bosses to place the top hinge pins in double shear when they are assembled through the link. The lugs shall be adjustable in the horizontal plane without removal of the cover from the gate links. The adjustment shall allow the top pivot point to be moved toward the gate seat for reduced sensitivity of the cover, or moved away from the gate seat to provide opening with minimum differential head. Two corrosion-resistant studs shall be used to connect each pivot lug to the gate seat.

2.5 LINKS

A. The links connecting the cover and pivot lugs shall be heavy duty and cast in one piece. Each link shall be provided with commercial grade, corrosion-resistant bushings at each pivot point. The bottom of the links shall be provided with an adjusting screw to properly align seating faces on the cover with respect to the seat. The links shall be designed to limit the double hinge action, preventing the cover from rotating sufficiently to become wedged in the open position.

2.6 FASTERNERS

A. All anchor bolts, assembly bolts, screws, studs and nuts shall be of ample size to safely withstand the forces created by operation of the gate under the heads shown in the "Gate Schedule". Quantity and size of the fasteners shall be of recommended by the manufacturer. Anchor bolts shall be furnished with two nuts each to facilitate installation and alignment of the gates when attached to concrete.

2.7 PAINTING

A. Machined surfaces shall be coated with a water-resistant, rust-preventive compound. All cast iron parts shall be shop cleaned and painted in accordance with the manufacturer's standard practice.

2.8 MATERIALS

A. The "Material Combination Number" included in the "Gate Schedule" and shown below defines the type of material for the component parts of the gates and accessories included in this specification. Materials shall conform to the requirements of the following ASTM standards. When more than one alloy, type or grade of material is shown, the exact alloy furnished must be at the manufacturer's option.

B. Cast Iron: ASTM A126, Class B

C. Austenitic Gray Iron Casting: (Ni-Resist) ASTM A436, Type 2

D. Stainless Steel (Faces & Anchors): ASTM A276, Type 302 or 304

E. Stainless Steel (Fasteners): ASTM F593 (Bolts), Alloy Group 1

F. Monel (Seating Faces and Fasteners): ASTM B164, Class A or B

G. Naval Bronze (Seating Faces): ASTM B21, Alloy 482

H. Silicon Bronze (Seating Faces): ASTM B98, Alloy 651

I. Rubber (Seating Faces): ASTM D2000, Grade 1BE625

J. Bronze (Bushings): ASTM B584, Alloy 932

K. Stainless Steel (Bushings and Pins): ASTM A582, Type 303

2.9 PRODUCTS

A. Manufacturers:

1. 12" Heavy-Duty Flap Gate Series 50C (circular), Flat Back Seat, Adjustable Upper Pivot, as manufactured by Hydro Gate. www.hydrogate.com, phone 800-678-8228.

2. 12" Standard Flap Valve (circular), cast iron body, No. E-3091, as manufactured by Penn-Troy Manufacturing Inc., phone 800-232-4442

3. 12" Flap Gate, Series FG-AC, FG-ACP or FG-SPR, as manufactured by Rodney Hunt / Fontaine, phone 800-448-8860

4. Or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation of all parts shall be done by the contractor in a workmanlike manner and in accordance with the manufacturer's instructions. It shall be the contractor's responsibility to handle, store and install the gate in strict accord with the manufacturer's drawings and recommendations.

END OF SECTION 334000

This Page Intentionally Left Blank

SECTION 334100

STORM DRAINAGE SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform excavation, backfill, trenching, compaction, and installing pipes and structures, as necessary to construct the drainage improvements as shown on the Contract Drawings or as directed by the Commissioner which include but not limited to:

1. Pipe and fittings
2. Pressure pipe and couplings
3. Cleanouts
4. Encasement for piping
5. Manholes
6. Catch basins
7. Trench drain
8. Area drain
9. Outfalls
10. Level spreader

B. Related Sections:

1. Section 312000 - Earthwork
2. Section 312319 – Dewatering
3. Section 315000 – Excavation Support and Protection
4. Section 334000 – Flap Gate
5. Section 334500 – Hydraulic Sluice Gate
6. Section 334600 - Sub Drainage
7. Section 334610 - Stormwater Underground Detention

1.3 DEFINITIONS

A. HDPE: Corrugated High Density Polyethylene Pipes

B. RCP: Reinforced Concrete Pipe, Type III unless specifically specified otherwise.

C. PVC: Polyvinyl Chloride pipes.

D. PP: Polypropylene Pipe

E. Copper Pipe

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

1. Manholes: Include plans, elevations, sections, details, frames, and covers.

2. Catch basins stormwater inlets and. Include plans, elevations, sections, details, frames, covers, and grates.

3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet (1:500) and vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality control reports.

E. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

B. Handle manholes according to manufacturer's written rigging instructions.

C. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by City of New York or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Commissioner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Commissioner's written permission.

PART 2 PRODUCTS

2.1 CORRUGATED POLYETHYLENE (PE) PIPE AND FITTINGS - HDPE

A. Pipe and Fittings: Type S, with smooth waterway for coupling joints.

1. 3" to 10": AASHTO M 252M,
2. 12" to 60": AASHTO M 294M

B. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work: Advanced Drainage Systems (ADS), Hancor Inc., Contech.

2.2 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.
2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work: Certaineed, J.M. Manufacturing, Vulcan Plastic, North American, ETI, Hawk

B. PVC Pressure Piping:

1. 4" – 12" Pipe: AWWA C900, Class 150 PVC pipe with bell-and-spigot ends for gasketed joints.
2. 12" and larger, AWWA C905, DR-18 minimum
3. Fittings: AWWA C900, Class 150 PVC pipe with bell ends
4. Gaskets: ASTM F 477, elastomeric seals.

5. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work: Certaineed, J.M. Manufacturing, Vulcan Plastic, North American, ETI.

2.3 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets

2.4 POLYPROPYLENE PIPE

A. Pipe: ASTM F2736 (for 6 to 30"), ASTM F2764 (for 30 to 60")

B. Corrugated polyethylene piping and fittings, with a diameter of 12 inches or more may be used in connection with any type of building for underground yard drainage and storm water piping when used outside of the foundation wall of the building and not connecting to any piping system from the interior of the building.

C. Corrugated polypropylene piping and fittings shall be designed and installed in accordance with the 2008 NYC Construction Codes and shall subject to special inspection requirement of Chapter 17 of the Building Code and 1RCNY section 101-06.

D. Polyropylene Pipes can be used as a substitute only upon written approval by the Commissioner.

2.5 COPPER PIPING

A. Type K copper piping: ASTM B88, size according to Project Drawings.

2.6 PRESSURE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to:

1. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 200-psig minimum pressure rating and ends sized to fit adjoining pipes.
2. Center-Sleeve Material: Ductile iron.
3. Gasket Material: Natural or synthetic rubber.
4. Metal Component Finish: Corrosion-resistant coating or material.

2.7 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inchminimum thickness and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber, as manufactured by Ram-Nek or approved equal.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
5. Steps: standard manhole steps at 12" on center.
6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 8-inch riser with 4-inch- minimum width flange and 27-inch diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "N.Y.C. SEWER." or approved other. Contractor to coordinate with Commissioner.
2. Material: ASTM A 48-A 48M, Class 35B gray cast iron, minimum weight, 130 lbs. unless otherwise indicated.

3. Design Loading: H-20 Highway Loading

2.8 GATE VALES

A. Resilient Seated:

1. Cast iron body, bronze mounted, double disc, resilient seated in conformance with AWWA C509 or C515, with a minimum working pressure of one hundred fifty (150) psi.

2. Valves shall have a two (2) inch operating nut and open left, and shall have O-ring seals.

3. Valve ends shall be mechanical joint or push on joint. Gate valves shall be installed in the upright vertical position.

B. All force main gate valves shall be set true and plumb and have a valve box centered over the valve.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work: Mueller, Kennedy, Clow, or approved equal.

2.9 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R (ACI 350M/350RM), and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.

2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.10 CATCH BASINS

A. Standard Precast Concrete Catch Basins:

1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
6. Retain one of first two subparagraphs below if required.
7. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
8. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
9. Steps: Individual FRP steps; FRP ladder; or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
10. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Designed Precast Concrete Catch Basins: ASTM C 913, precast, reinforced concrete; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: ASTM C 990, bitumen or butyl rubber.
2. Retain one of first two subparagraphs below if required.
3. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
4. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and grate.
5. Steps: wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12-inch

intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.

6. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

C. Frames and Grates: Frames, Grate and Curb Piece: Heavy duty, according to NYCDEP Sewer Design Standards, latest edition.

D. Catch Basin Types:

1. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards. NYCDEP Type 1 Catch Basins.

2. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates. NYCDEP Type 2 Catch Basins.

3. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

2.11 CAST IRON HOOD AND HOOKS

A. All catch basins shall equip with hood and hooks in the inlet.

B. Material and construction as per NYCDEP Sewer Design Standard "Standard for Cast Iron Hood and Hooks for Catch Basin", latest edition.

2.12 TRENCH DRAIN

A. DURASLOT/LEVEL SPREADER

1. The slot drain type trench drain hall have a smooth interior and annular exterior corrugations with an aluminum slot mounted longitudinally along the length of the pipe to accept the grate frame while maintaining the original pipe diameter.

2. 4- through 10-inch (100 to 250mm) pipe shall meet AASHTO M252, Type S.

3. 12- through 36-inch (300 to 900 mm) pipe shall meet AASHTO M294, Type S or ASTM F2306.

4. Manning's "n" value for use in design shall be 0.012.

5. The aluminum grate frame shall be manufactured from 0.063" tempered commercial aluminum meeting the requirements of ASTM B209, consisting of two parallel plates separated by spacers spanning the slot on 6" centers. The grate shall be ½ - #13 galvanized steel meeting the requirements of ASTM F1267, Type 2, Class 2. The grate shall have a diamond-shaped opening and be ADA compliant. The flange at the bottom of the aluminum grate shall be riveted to the pipe with a minimum of two rivets per linear foot.

6. Fittings: DURASLOT fittings shall be modified from fittings which conform to AASHTO M252, AASHTO M294, or ASTM F2306

7. Manufacturer:

   1. ADS

   2. ACO

   3. Zurn

   4. Or Approved Equal

2.13 AREA DRAIN

A. Drain basins: manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration and shall conform to ASTM D1784 cell class 12454.

B. Drainage pipe connection stubs: manufactured from PVC pipe stock formed to provide a watertight connection.

C. Joint tightness: conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals.

D. Flexible elastomeric seals: conform to ASTM F477.

E. Pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.

F. Grates and Frames: ductile iron, painted black, H-20 loading. For sizes 8", 10", 12", 15", 18", 24" and 30" and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. For 12" and 15" square grates will be hinged to the frame using pins.

G. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron.

H. Manufacturer:

   1. ADS

   2. Nyloplast

   3. Or approved equal.

2.14 PIPE OUTLETS

A. Headwalls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Aprons: Broken, irregularly sized and shaped, graded stone according to NYSDEC Erosion and Sediment Control Standard.

C. Filter Stone: No. 4 screen opening, average-size graded stone or according to NYSDEC Erosion and Sediment Control Standard.

D. Energy Dissipaters: No. A-1, 3-ton average weight armor stone, or according to NYSDEC Erosion and Sediment Control Standard.

2.15 TRACE WIRE

A. Materials

1. General

   a. Install trace wire for all non-gravity storm pipes or pipes that are not located in a straight line between two structures.

   b. All trace wire and trace wire products shall be domestically manufactured in the U.S.A.

   c. All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

2. Trace wire

   a. Open Trench - Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.

   b. Directional Drilling/Boring - Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.

   c. Trace wire – Pipe Bursting/Slip Lining - Trace wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

3. Connectors

   a. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.

   b. Direct bury wire connectors – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any un-insulated wire exposure.

   c. Non locking friction fit, twist on or taped connectors are prohibited.

4. Termination/Access

   a. All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.

   b. All grade level/in-ground access boxes shall be appropriately identified with "sewer" or "water" cast into the cap and be color coded.

c. A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.

d. All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.

e. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

f. Service Laterals on public property - Trace wire must terminate at an approved grade level/inground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.

g. Service Laterals on private property - Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.

h. Hydrants – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable)

i. Long-runs, in excess of 500 linear feet without service laterals or hydrants - Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked.

5. Grounding

a. Trace wire must be properly grounded at all dead ends/stubs

b. Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.

c. When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.

d. When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

e. Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

B. Installation

1. General

a. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

b. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

c. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

d. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.

e. Trace wire must be properly grounded as specified.

f. Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)

g. At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)

h. Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

i. All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.

j. In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

2. Storm Sewer System

a. A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.

b. Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.

c. Trace wire on all storm service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right of way.

C. Prohibited Products and Methods

1. The following products and methods shall not be allowed or acceptable
   a. Un-insulated trace wire
   b. Trace wire insulations other than HDPE
   c. Trace wires not domestically manufactured
   d. Non locking, friction fit, twist on or taped connectors
   e. Brass or copper ground rods
   f. Wire connections utilizing taping or spray-on waterproofing
   g. Looped wire or continuous wire installations, that has multiple wires laid side-by-side or in close proximity to one another
   h. Trace wire wrapped around the corresponding utility
   i. Brass fittings with trace wire connection lugs
   j. Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
   k. Connecting trace wire to existing conductive utilities

D. Testing

1. All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, Commissioner and facility owner as applicable, prior to acceptance of ownership.
2. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.
3. Continuity testing in lieu of actual line tracing shall not be accepted.

PART 3 EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earthwork".

3.2 PIPING INSTALLATION

A. All storm drainage piping and associated fittings, not connected to building interior, shall be composed of polypropylene.

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install

gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of micro-tunneling.

G. Install gravity-flow, non-pressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping nominal pipe size 6-inch and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install ductile-iron piping and special fittings according to AWWA C600 or AWWA M41.
5. Install PE corrugated sewer piping according to ASTM D 2321.
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

H. Install force-main pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
2. Install piping with 36-inch minimum cover.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.
5. Install PVC pressure piping according to AWWA M23, or ASTM D 2774 and ASTM F 1668.

I. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105:

1. Underground copper pipe and fitting.
2. Hub-and-spigot, cast-iron soil pipe and fittings.
3. Hubless cast-iron soil pipe and fittings.
4. Ductile-iron pipe and fittings.

5. Expansion joints and deflection fittings.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, non-pressure drainage piping according to the following:

1. Join ductile-iron culvert piping according to AWWA C600 for push-on joints.
2. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
3. Join PVC corrugated sewer piping according to ASTM D 2321 for elastomeric-seal joints.
4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasketed joints.
5. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.

B. Join force-main pressure piping according to the following:

1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping according to AWWA M23 for gasketed joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 1 inches above finished surface elsewhere unless otherwise indicated.

3.5 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.7 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.8 CONNECTIONS

A. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, according to piping manufacturer's written instructions.

B. Connect non-pressure, gravity-flow drainage piping in building's storm building drains specified in Section 221413 "Facility Storm Drainage Piping."

C. Connect force-main piping to building's storm drainage force mains specified in Section 221413 "Facility Storm Drainage Piping." Terminate piping where indicated.

D. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

2. Make branch connections from side into existing piping, nominal pipe size (NPS) 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

   a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

   b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

E. Connect pipes and temporary swales to sediment traps specified in Section 312500 "Erosion and Sediment Controls".

F. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use non-pressure-type flexible couplings where required to join gravity-flow, non-pressure sewer piping unless otherwise indicated.

a. Unshielded flexible couplings for same or minor difference OD pipes.

b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

3.9 TRENCH DRAIN INSTALLATION

A. Install type of trench and slot drains in locations indicated as per manufacturer's specifications and requirements.

B. Embed drains in 4-inch minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

3.10 AREA DRAIN INSTALLTION

A. The PVC area drains shall be installed using conventional flexible pipe backfill materials and procedures. The backfill material shall be crushed stone or other granular material meeting the requirements of class 2 material as defined in ASTM D2321.

B. Bedding and backfill shall be placed and compacted uniformly in accordance with ASTM D2321.

C. The drain basin body will be cut at the time of the final grade. No brick, stone or concrete block will be required to set the grate to the final grade height.

D. For H-20 load rated installations, a concrete ring will be poured under and around the grate and frame. The concrete slab must be designed taking into consideration local soil conditions, traffic loading, and other applicable design factors.

E. For other installation considerations such as migration of fines, ground water, and soft foundations refer to ASTM D2321 guidelines.

3.11 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.

2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.

2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 312000 "Earthwork."

3.12 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Damage: Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.

5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.

   b. Option: Test plastic piping according to ASTM F 1417.

   c. Option: Test concrete piping according to ASTM C 924.

6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.

   a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.

   b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 334100

SECTION 334500

HYDRAULIC SLUICE GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform excavation, backfill, trenching, compaction, and paving, as necessary to construct temporary excavation support and protection systems necessary for the improvements as shown on the Contract Drawings or as directed by the Commissioner.

B. Equipment provided shall be cast, fabricated, machined, assembled and placed in proper operating condition per the drawings, specifications, engineering data, instructions and recommendations of the gate manufacturer unless otherwise noted by the Commissioner. Gates and operators shall be supplied with all parts and accessories as specified within the site specifications, drawings and as required for a complete installation.

C. Cast iron sluice gates where shown in the plans and specifications and listed in the sluice gate schedule shall be as manufactured by Coldwell-Wilcox Technologies, LLC of Cincinnati, Ohio, Rodney Hunt-Fontaine Inc., Penn-Troy Manufacturing, Inc. or Approved Equal. Gates shall be cast iron, ductile iron, 2% nickel or NiResist, self-contained or conventional rising or non-rising stem type with surface mounted guide frames as called out by the specifications and site drawings. Cast iron is most common material of choice.

1.3 REFERENCE STANDARDS

A. Except as modified or supplemented herein, all gates and operators shall conform to the applicable AWWA standards.

1.4 SUBMITTALS

A. Manufacturer's data and drawings shall be submitted for approval in accordance with site specifications and engineering drawings. Manufacturer's submittal shall include but not limited to gate material specification sheet, gate data summary sheet, calculation sheets, site plan drawings and paint/coating data sheets. Calculation sheets shall contain operator forces, tensile and buckling strength of stem, structural strength calculations and other calculations to verify that the design meets the specification requirements.

B. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

    a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

    b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

    c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

    d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs./gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

    a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

    b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

    c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

1.5 QUALITY ASSURANCE

A. Gates shall be designed and shop tested to the applicable AWWA governing standard. Design and operating heads shall be per the site schedule and/or specifications.

PART 2 PRODUCTS

2.1 MANUFACTURERS / MATERIALS

A. All materials will comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. Sluice gates shall be the latest standard product in regular production by a manufacturer whose products have proven reliable in similar service. A single manufacturer shall supply sluice gates.

2. Frame: Leaf (Disc), ASTM A126 Class B Cast Iron, Side Guides, Ductile Cast Iron, ASTMA536, Class B, Wall Thimbles, Cast Iron ASTM A126 Class B with 2% Nickel, NiResist ASTM A436 Type 1 (15% Nickel) or NiResist ASTM A436Type 2 (22% Nickel

3. Stem: ASTM A276 Type 304(L) or 316(L) Stainless Steel

4. Wedges: ASTMB584 CA873 Bronze

5. Seat: ASTM B98 CA 655 Bronze

6. Flushbottom Seal: ASTM D2000 50-60 Durometer Neoprene

7. Flushbottom Retainer ASTM A276 Type 304(L) or 316(L) Stainless Steel

8. Thrust Nut: ASTM B584 CA954 Bronze

9. Stop Collars: ASTM B584 CA954 Bronze or ASTM A276 Type 304 or 316 Stainless Steel

10. Stem Coupling: ASTM B584 CA954 Bronze or ASTM A276 Type 304 or 316 Stainless Steel

11. Fasteners: ASTM A276 Type 304 or 316 Stainless Steel

12. Stem Guide: Bearing ASTM B584 CA932/CA864 Bronze or UHMW

13. Stem Guide: Bracket Ductile Iron, 304(L) or 316(L) Stainless Steel or A36 Steel

14. Floorstands: ASTM A126 Class B Cast Iron or A36 Steel Wall Brackets

15. Stem Cover: Butyrate, Clear

16. Handwheel: ASTM A-126, Class B Cast Iron

17. Handcrank: A36 Steel

18. Yoke: A36 Steel

2.2 SLUICE GATES

A. Sluice gates shall be cast iron, fully bronze mounted and will have side wedges, top wedges and flush bottom seal or bottom wedges. Sluice Gates less than 24" wide shall have side wedges only. Flush bottom type seal shall have a neoprene seal flush across the invert and standard bottom shall have bronze seat face and wedges. CWT standard is flush bottom seal type with bronze seat and wedges optional. All gate components will be designed to safely withstand the heads listed in the sluice gate schedule.

2.3 DISC OR SLIDE

A. Disc shall be cast iron, one-piece construction, with integrally cast vertical and horizontal ribs. The disc will have machined dovetailed grooves on the seating face into which bronze facings shall be driven and machined to a 63 micro-inch finish. A tongue on each side extending the full length of the disc shall be machined on all sides with a 1/16 inch clearance maintained between the disc tongue and the gate guide groove. Wedge pads for side, top and bottom wedges, when required, will be cast integrally on the disc and machined to receive the adjustable bronze wedges. A heavily reinforced nut pocket shall be cast integrally on the vertical centerline and above the horizontal center and be such shape as to receive the square or rectangular bronze thrust nut with stem attached.

2.4 FRAME

A. Gate frame and guides shall be cast in one piece and shall be flat back (flange back) as designated in the gate schedule. The back of the frame shall be machined to a plane.

B. Guides shall be cast as an integral part of the frame or bolted and pined to the frame and shall be sufficiently long to retain at least one-half of the vertical height of the disc when in the fully opened position. Guides shall be capable of safely withstanding the full thrust due to water pressure and wedging action. Guide grooves shall be accurately machined to provide free movement of the disc tongues and to insure proper engagement of the wedging devices.

2.5 WEDGES

A. Wedges shall be solid cast bronze and keyed to the cast iron pads to maintain adjustment by preventing undesirable rotation or lateral motion. They will be attached to the disc with 304 or 316 stainless steel studs, nuts, washers and adjusting screws with locking nuts. Silicon bronze studs, nuts and adjusting screws with locking nuts shall be used when specified.

2.6 SEAT FACINGS

A. All seat facings shall be malleable extruded bronze of a composition, which will resist dezincification and will increase in wearing ability with cold working. The extruded seat facings will be a special shape to fill and permanently lock in the machined dovetail grooves when impacted into place. Attaching pins and screws shall not be allowed. The installed seat facings shall be machined to a 63 micro-inch finish or better.

2.7 FLUSHBOTTOM SEAL

A. Gates so designated in the gate schedule shall be provided with a flush bottom seal. All gate parts shall be identical to those defined in other paragraphs of this specification except for the bottom of the slide and the seal assembly along the invert of the waterway opening. The flush bottom closure creates a smooth invert which does not impede flow. A heavy resilient neoprene strip flush across the invert width is epoxyed in a stainless steel retainer. The 3/4" minimum bottom thickness of the gate leaf (disc) effectively seals the invert when compressed against the 50-60 durometer neoprene flush bottom seal. The neoprene flushbottom seal replaces the standard bottom seat facings and wedging devices.

B. Top surface of the seal shall be flush with the invert of the gate opening. Full length of disc bottom edge shall be accurately machined to make contact with the seal when the disc is closed. The seal shall be replaceable without removal of gate disc.

2.8 WALL THIMBLE

A. Wall thimbles will be furnished as required by specification. Wall thimbles shall be of section "F", "E" or "MJ" (mechanical joint) and depth as indicated on the plans and listed in the gate schedule. They will be cast iron, ductile, 2% nickel or NiResist one-piece construction, of adequate section to withstand all operational and reasonable installation stresses. Wall thimbles will be internally braced during concrete placement. A center ring or water stop will be cast around the periphery of the thimble. The front flange will be machined and have tapped holes for the sluice gate attaching studs and metal stamped vertical centerlines with the word "TOP" for correct alignment.

B. Large wall thimbles will be provided with holes in the invert to allow satisfactory concrete placement beneath the thimble.

2.9 STEM

A. Operating stem shall be of Type 304(L) or 316(L) stainless steel minimum 1-1/4 inches diameter and attached to the disc by bronze thrust nut and cast in place disc pocket. Stem shall be designed to transmit in compression at least 2-1/2 times the rated output of the operating mechanism with a 40-pound maximum effort on the crank or hand wheel.

B. Stems shall have a slenderness ration (L/R) of 200 or less. The threaded portion of the stem shall have machine cut 1/4" pitch by 1/4" lead left hand threads of the Acme type unless otherwise specified. Stainless steel or manganese bronze couplings threaded and keyed, or bored and pinned to the stems shall join stems of more than one section. All threaded and keyed couplings of the same size shall be interchangeable. Stems shall be provided with adjustable stop collars to prevent over travel on manually operated gates.

2.10 STEM GUIDES

A. Stem guides shall be bronze or UHMW bushed Ductile iron, 304/316 stainless steel or A36 steel. They shall be adjustable in two directions and will be spaced at sufficient intervals to adequately support the stem. Stem guide spacing shall not exceed 10 feet.

2.11 SELF-CONTAINED SLUICE GATES

A. Self-contained sluice gate shall have the standard extended side guides to allow the gate to fully open. A heavily designed "U" shape structural steel yoke shall be attached to the machined pads a top the side guides. A mounting plate shall be bolted to the yoke horizontal cross supports for manual or electric actuator mounting.

2.12 ADDITIONAL OPTIONAL SEALS (UNSEATING SIDE ONLY)

A. Neoprene "J" or "P" seal can be bolted to the cast frame for additional sealing capabilities on the unseating side. Hardware shall be Type 304 or 316 stainless steel. Bronze hardware is optional.

2.13 MANUAL OR ELECTRIC OPERATED GATES

A. Handwheel (horizontal mounted) type:

1. A hand wheel operator shall be provided with a 1:1 ratio.

2. An acme threaded manganese bronze lift nut shall be provided to engage the operating stem.

3. Anti-friction bearings shall be provided to properly support both opening and closing thrusts.

4. The hand wheel shall operate the gate under the specified operating heads with not greater than a 40 pound rim pull approximately 36 inches above the operating floor.

5. All components shall be totally enclosed in a cast iron weatherproof housing.

6. Hand wheel operator shall be bench stand (yoke) mounted or floor stand mounted with or without a cast iron or fabricated A36 steel wall bracket.

B. Handcrank or vertical handwheel gearbox mounted type:

1. A hand- crank or handwheel operated gearbox shall be provided with a gear ratio as needed to ensure 40 pounds or less rim pull at the handcrank or handwheel under the specified operating heads approximately 36 inches above the operating floor.

2. An acme threaded manganese bronze lift nut shall be provided to engage the operating stem. Anti-friction bearings shall be provided to properly support both opening and closing thrusts.

3. All components shall be totally enclosed in a cast iron weatherproof housing. Gearbox shall be bench stand (yoke) mounted or floor stand mounted with or without a cast iron or A36 steel fabricated wall bracket.

C. Tee Wrench Type:

1. A tee wrench operated 2" square nut stem mounted with a 1:1 ratio or a 2" square nut gearbox mounted with a gear ratio as needed to ensure 40 pounds or less rim pull at the tee wrench under the specified operating heads.

2. A manganese bronze lift nut shall be provided to engage the operating non-rising stem. Anti-friction bearings shall be provided to properly support both opening and closing thrusts.

3. All components shall be totally enclosed in a cast iron weatherproof housing.

4. Tee wrench operator shall be bench stand mounted (yoke), floor box mounted or cast iron/A36 steel fabricated wall bracket mounted

D. Electric Actuator Type:

1. Electric actuators shall be sized for the required breakout torque and average operating torque including a 1.33 minimum safety factor.

2. Electric actuators shall be bench stand (yoke) or pedestal mounted. Actuators can be either open/close or modulating service and shall be designed for twelve inches (12") per minute disc travel (48 RPM actuator speed).

3. Disc travel may vary from nine (9) to fifteen (15) inches per minute depending on design requirements. Electric motor actuator shall include, but not limited to, the motor, gearing unit, limit switches, torque switches, manganese bronze stem nut, declutch lever, compartment heater and hand wheel for manual operation at 40 pounds or less rim pull.

4. As a minimum, the motor actuator shall be Nema 4 (weathertight) construction. Coldwell-Wilcox Technologies furnishes electric actuators manufactured by EIM, Limitorque, Auma, Rotork or equal.

5. A clear butyrate stem cover with closed, open, 1/4, 1/2 and 3/4 position indicator decals shall be supplied for each rising stem.

2.14 PAINTING

A. Steel components such as the cast frame, disc, hand wheel and operator bearing housing shall receive manufacturer's standard TNEMEC epoxy series N140-1255 pota-pox beige OR APPROVED EQUAL and TNEMEC series 69 pond 28BL OR APPROVED EQUAL finish prior to shipment. Total system shall be 12-16 mils DFT.

B. Tnemec coal tar epoxy series 46H-413 or Tnemec potable epoxy series N140 pota pox are available, as specifications require. Coal tar epoxy total system shall be 20-26 mils DFT. Tnemec potable epoxy total system shall be 12-16 mils DFT. Or approved equal.

2.15 SHOP TESTING

A. Each gate shall be fully assembled and shop-inspected in the vertical position for proper seating. The disc shall be fully opened and closed in its guide system to ensure that it operates freely and seals per the AWWA standard.

2.16 PRODUCTS

A. Manufacturers:

1. Rodney Hunt
2. Penn-Troy Manufacturing Inc.
3. Golden Harvest, Inc.
4. OR APPROVED EQUAL

END OF SECTION 334500

SECTION 334600

SUBDRAINAGE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to perform excavation, backfill, trenching, compaction, pipe and drainage structure installation and connections, as necessary to construct the subdrains for landscaping, storm sewer, foundation drains, and retaining wall drains as shown on the Contract Drawings or as directed by the Commissioner.

B. Coordinate with Site, Plumbing, Structural and Landscaping Drawings.

1.3 RELATED SECTIONS

A. Section 334100 – Storm Drainage System

1.4 SUBMITTALS

A. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each

product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with Division 1 – General Requirements.

PART 2 PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated Polyethylene (PE) Pipe and Fittings:

1. Nominal pipe size (NPS) 6" and smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

2. Nominal pipe size (NPS) 8" or larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.

3. Couplings: Manufacturer's standard, band type.

2.2 SOIL MATERIALS

A. Soil materials are specified in Section 312000 - Earthwork and Section 312316 - Rock Removal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where sub-drainage systems are to be installed.

B. If sub-drainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Verify that drainage panels installed as part of foundation wall waterproofing is properly positioned to drain into sub-drainage system.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earthwork" and Section 312316 "Rock Removal".

3.3 FOUNDATION DRAINAGE INSTALLATION

A. Place impervious fill material on subgrade adjacent to bottom of footing after concrete footing forms have been removed. Place and compact impervious fill to dimensions indicated, but not less than 6 inches deep and 12 inches wide.

B. Install drainage piping as indicated in "Piping Installation" subsection for foundation subdrainage.

C. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

D. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

E. Place backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Place final backfill to finish elevations and slope away from building.

3.4 RETAINING-WALL DRAINAGE INSTALLATION

A. Place supporting layer of drainage course over compacted subgrade to compacted depth of not less than 4 inches.

B. Install drainage piping as indicated in "Piping Installation" subsection for retaining-wall subdrainage.

C. Add drainage course to width of at least 6 inches on side away from wall and to top of pipe to perform tests.

D. After satisfactory testing, cover drainage piping to width of at least 6 inches on side away from footing and above top of pipe to within 12 inches of finish grade.

E. Fill to Grade: Place satisfactory soil fill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.5 LANDSCAPING DRAINAGE INSTALLATION

A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.

B. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches.

C. Fill to Grade: Place satisfactory soil fill material over drainage course. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish grade.

3.6 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Sub-drainage: Install piping level and with a minimum cover of 36 inches unless otherwise indicated.

2. Retaining-Wall Sub-drainage: When water discharges at end of wall into stormwater piping system, install piping level and with a minimum cover of 36 inches unless otherwise indicated.

3. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches unless otherwise indicated.

4. Lay perforated pipe with perforations down.

5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install thermoplastic piping according to ASTM D 2321.

3.7 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings according to ASTM D 3212 with loose banded, coupled, or push-on joints.

B. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.8 BACKWATER VALVE INSTALLATION

A. Comply with requirements for backwater valves specified in Section 334100 - Storm Drainage System.

B. Install horizontal backwater valves in header piping downstream from perforated sub-drainage piping.

C. Install horizontal backwater valves in the manhole where indicated.

3.9 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 - Storm Drainage System.

B. Cleanouts for Foundation Retaining-Wall Landscaping Sub-drainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.

2. In non-vehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.

3. Comply with requirements for concrete specified in Section 033000 - Cast-in-Place Concrete.

3.10 CONNECTIONS

A. Comply with requirements for piping specified in Section 334100 - Storm Drainage System. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect low elevations of sub-drainage system to solid-wall-piping storm drainage system.

C. Where required, connect low elevations of foundation sub-drainage to stormwater sump pumps. Comply with requirements for sump pumps specified in Section 221429 - Sump Pumps.

3.11 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 312000 - Earthwork.

1. Install PE warning tape or detectable warning tape over ferrous piping.

2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.12 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.

2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.13 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 334600

SECTION 334610

STORMWATER UNDERGROUND DETENTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

B. Examine all drawings and other sections of the specifications for requirements therein affecting the work of this trade.

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, permitting and services needed to construct the underground stormwater detention systems as shown on the Contract Drawings or as directed by the Commissioner, which include but not limited to:

1. Provide excavation and base preparation per Commissioner's recommendations and/or as shown on drawings, to provide adequate support for project designs loads and safety from excavation sidewall collapse. See 2.2 Materials.

2. Provide and install underground detention system products including but not limited to the stormwater storage modular cell units, geotextiles, geogrids, inlet and outlet pipe with connections and installation per the manufacturer's instructions furnished under this section.

3. Contractor may submit an alternate underground detention system with the same or better performance as shown on the Drawings, to the Commissioner for review and approval. The alternate underground detention system and design should have a similar overall footprint and depth, exceeds H-20 loading, provides the same or more storage capacity, limits to the same rate and volume of discharge, and does not affect the upstream and downstream drainage system design.

B. Related Work: The following items are noted and included in this Section and will be performed under the designated sections:

1. Section 312000 – Earthwork

2. Section 312316 – Rock Removal

3. Section 312319 – Dewatering

4. Section 315000 – Excavation Support and Protection

5. Section 334100 – Stormwater Drainage System

1.3 REFERENCE STANDARDS

A. The following standards are applicable to the work of this Section to the extent referenced herein:

1. ASTM: American Society for Testing and Materials.

2. ANSI: American National Standards Institute.

3. AASHTO: American Association of State Highway and Transportation Officials.

4. AWWA: American Water Works Association.

1.4 SUBMITTALS

A. Submit manufacturer's product data and installation instructions.

B. Submit a modular cell section of the underground detention product for review. Reviewed and accepted samples will be returned to the Contractor.

C. Submit material certificates for geotextile, geogrid, base course and backfill materials.

D. Submit shop drawings as reviewed by the manufacturer prior to submit to the Commissioner for review and approval.

E. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

   b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

   c. Concrete mix used in this section shall contain a minimum of 40% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials), subject to the approval of the Commissioner. Certification and submittal of recycled content shall be in accordance with the DDC General Conditions.

1.5 QUALITY ASSURANCE

A. Refer to information within this specification related to Shop Drawings, Product Data, and Sample requirements.

B. Installation: Performed only by skilled work people with satisfactory record of performance on pipe, chamber, or pond/landfill construction projects of comparable size and quality.

C. The Contractor or subcontractor performing the work in this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cells from damage during delivery and store under tarp to protect from sunlight when time from delivery to installation exceeds one week. Storage should occur on smooth surfaces, free from dirt, mud and debris.

B. Handling is to be performed with equipment appropriate to the size (height) of cells and site conditions, and may include, hand, handcart, forklifts, extension lifts, small cranes, etc., with care given to minimize damage to spacer bars and surrounding cells.

1.7 PROJECT CONDITIONS

A. Review installation procedures and coordinate the underground detention system work with other work affected, such as grading, excavation, utilities, construction access, erosion control to prevent all non-installation related construction traffic over the completed underground detention system installation, especially with loads greater than design loads.

B. Cold weather:

1. Do not use frozen materials or materials mixed or coated with ice or frost.

2. Do not build on frozen work or wet, saturated or muddy subgrade.

3. Care must be taken when handling the modular rainwater storage cells when air temperature is at 40 degrees or below as plastic becomes brittle.

C. Protect partially completed rainwater storage module installation against damage from other construction traffic when work is in progress, and following completion of backfill, with highly visible construction tape, fencing, or other means until construction is complete.

D. Protect adjacent work from damage during the underground detention system installation.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Manufacturer:

1. Rainstore3 by Invisible Structures, Inc. 1600 Jackson Street, Suite 310, Golden, Colorado 80401. Tel: 800-233-1510. www.invisiblestructures.com

2. R-Tank by ACF Environmental, Tel: 800-448-3636. www.acfenvironmental.com

3. Atlantis D-Raintank Modular Rainwater Storage System by RainHarvest Systems, LL. 6075 Parkway North Drive, Cumming, GA 30040, Tel: 800-654-9283. www.rainharvest.com

4. StormTank Modules by Brentwood Industries. 500 Spring Ridge Drive, Reading, PA 196100. Tel: 610-374-5109. www.brentwoodindustries.com

5. Or Approved Equal

2.2 MATERIALS

A. Material requirements shall adhere to the Manufacturer's recommendations specific for the particular underground detention system provided.

B. Base of Excavation: Shall be smooth soil, level and free of lumps or debris. Compact to at least 95% or as required by the manufacturer. Structural fill material may be used to amend the structural capacity of the soil, and should be placed on top of the geogrid layer

if needed. Materials that cannot be stabilized by compaction, such as sand and/or drainage rock, should be avoided.

C. Geogrid: Use manufacturer approved geogrid product to overlay the excavation floor, the assembled cells, and above the completed liner, extending at least twice the width of side backfill, with geogrid joints overlapped by at least 12".

D. Geotextile: Shall be manufacturer approved non-woven PP or PET with a weight of at least 8 oz per square yard, appropriate for the soil type and depth conditions, placed on the floor of the excavation, the sides of the chamber, and chamber top.

E. Stormwater storage modular cells: Injection molded plastic units (sizes and shapes varies per manufacturer) assembled into vertical columnar and/or horizontal rows of cell structures of variable height and width (custom for each project) with each layer consisting of hollow space from a strong open grid unit. Each modular unit must be installed whole without cutting or modifications unless as permitted by the manufacturer.

F. Side Backfill: Structural fill free from lumps and debris or any other sharp materials to backfill along the sides of the cellular structure, taking care to compact with powered mechanical compactor, in lifts that do not exceed 12", to provide a settlement free-surface over the top and sides of the structure. Fill material should NOT consist of high percentage of clay or silt materials. Fill material should increase in shear strength when compacted; thus, no drain rock or pure open-graded rock allowed.

G. Top Backfill: Use 12" minimum to 36" maximum depth of 3/4" minus sandy/gravel road base material (with fines less than 3%). If backfill mixture must be custom mixed, use a ratio of 2 parts clean 3/4" drainage rock to 1 part clean sharp sand.

H. Utility Marker: Use metallic tape at corners of install to mark the area for future utility detection.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine prepared excavation and conditions for smoothness, compaction and level. Do not start the underground detention system installation until unsatisfactory conditions are corrected. Check for presence of seasonal high water table, which must be kept at levels 3 feet below the bottom of the underground detention structure at all times.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory, contact the Commissioner for resolution.

3.2 EXCAVATION

A. All excavation and installation requirements shall adhere to the Manufacturer's recommendations specific for the particular underground detention system provided.

B. Excavation must be extended at least 20" beyond all sides of the underground detention structures to allow for ease of product installation stormwater storage modular cells and backfill compaction with powered compactor. Soil below must be leveled. A layer of geogrid must be placed on subsoil and extend 20" beyond the sides of the structure.

C. A 12" minimum, 36" maximum structural base course (no greater than 1" particle size) must cover the geogrid and extend past all perimeters of the underground detention system by 20". Compact this layer to a minimum 95% modified Proctor density.

D. Large and deep storage volumes may demand a drivable access route for excavation, leveling, compaction and placing the modular cell structures.

E. Take extreme care when driving and/or compacting over the modular cell chambers and do not drive over exposed units. Wait until ALL modular cell units are installed, the backfill is complete, fabric and geogrid layers are completed, and an adequate amount of cover material is placed. Mark area to identify the overall underground chamber location.

3.3 PREPARATION

A. Place geogrid over prepared grade, with any joints overlapped by a minimum of 12", extending over the entire excavation bottom.

B. Place the geotextile fabric on the geogrid, extending the excess portion of the rolls up the sides of the excavated area. Overlap the geotextile joints 12" or per manufacturer's recommendations.

C. It is helpful to identify the outline of the stormwater storage modular cell placement on the fabric, using spray paint or chalk line to ensure squareness.

D. The geotextile fabric will later be brought up and encompass all sides and the top of the modular cell units.

3.4 INSTALLATION OF STORMWATER STORAGE MODULAR CELLS

A. Install the Stormwater storage modular cells by placing side by side, with grid side down. Try to place sides of cells without damaged bumpers along outside of structure to resist backfill forces against fabric and liner materials. DO NOT cut the cells – cells must be installed whole. Cutting of the Stormwater storage modular cells is only permitted for installation of maintenance ports. DO NOT disassemble, reassemble, or reconfigure the height (stacks) of stormwater storage modular cells. Place metallic tape on top corners of install to mark the area for future utility detection. Place a layer of geogrid directly over the top of the cells to bridge columns and joints and provide a secure walking surface. Place geotextile fabric layer over the top and sides to prevent soil entry into the chamber. Take great care to avoid damage to fabric liner material during placement.

B. After placement of the stormwater storage modular cells, bring liner material up the sides and over the top of the structure, overlapping or sealing joints per manufacturer's recommendations. Fold excess fabric at corners to lay flat against sides of structure, securing folds and seams with staples or similar methods.

C. Identify locations of inlet, outlet, inspection ports, and any other penetrations of the liner, securing pipe into prefabricated boots with stainless steel pipe clamps. Support pipe in trenches and during backfill operations to prevent damage to liner or pipe.

D. With chambers greater than 4 feet deep, place piles of cover material over closed chamber top surface along the edge of the chamber to provide vertical load on perimeter cells. This will ensure compression of the columns and aid in resistance to side pressures from backfill operations.

E. Use a powered mechanical compactor to conduct backfill operations on structure sides with care to avoid damage to liner while providing required compaction forces to the top level of the structure.

F. Place a geogrid layer over the top of the structure, extending beyond the outside edge of the excavation by at least 40". Any joints must be overlapped by a minimum of 12".

G. Place sufficient sandy gravel backfill material over geogrid to ensure support of design loads. Place cover backfill in 6" lifts and compact with vibrating plates or walk-behind rollers (do not use drivable rolling compactors) to a minimum of 95%, with a minimum depth of 12" and a maximum depth of 36". Take care to place backfill on top of structure and avoid damage to structure or liner, using low pressure tire or track vehicles.

H. Ensure that all non-chamber construction traffic be kept away from the limits of excavation until the project is complete and final surface materials are in place.

I. Place surfacing materials, such as groundcovers (no shrubs or trees), or paving materials over the structure with care to avoid displacement of cover fill and damage to surrounding areas.

J. Any slopes creating additional overburden above the underground detention system should be carefully located. The toe of said slope should be 10' away from the closest edge of the underground detention system. This will prevent any additional earth pressure on the underground detention system.

3.5 CLEANING

A. Perform cleaning during the installation of work and upon completion of the Work. Remove from site all excess materials, debris, and equipment. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

END OF SECTION 334610

This Page Intentionally Left Blank

SECTION 334713

WETLAND LINERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The following documents apply to all required work for the Project: (1) the Contract Drawings, (2) the Specifications, (3) the General Conditions, (4) the Addendum and (5) the Contract [City of New York Standard Construction Contract].

1.2 SUMMARY

A. The work specified in this Section consists of the labor, equipment, tool, materials, and services needed to install the wetland liner shown on the Contract Drawings or as directed by the Commissioner.

B. Installation of Wetland Liner includes, but is not limited to, coverage of subgrade in Wetland Cells 1 through 9.

C. Related Sections

1. Section 312000 – Earthwork
2. Section 327200 – Plantings for Wetland Areas

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D 638 – Standard Test method for Tensile Properties of Plastics
2. ASTM D 1004 – Test Method for Initial Tear Resistance of Plastic or Film Sheeting
3. ASTM D 2216 – Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-aggregate Mixtures
4. ASTM D 4354 – Standard Practice for Sampling of Geosynthetics for Testing
5. ASTM D 4643 – Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
6. ASTM D 4759 – Standard of Practice for Determining the Specification Conformance of Geosynthetics
7. ASTM D 4833 – Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Other Related Products
8. ASTM D 5084 – Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
9. ASTM D 5199 – Measuring Nominal Thickness of Geotextiles and Geomembranes

10. ASTM D 5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

11. ASTM D 5887 – Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Using Flexible Wall Permeameter

12. ASTM D 5888 – Identification, Storage, and Handling of Geosynthetic Clay Liners

13. ASTM D 5889 – Standard Practice for Quality Control of Geosynthetic Clay Liners

14. ASTM D 5890 – Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners

15. ASTM D 5891 – Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners

16. ASTM D 5993 – Standard Test Method for Measuring Mass Per Unit Area of Geosynthetic Clay Liners

17. ASTM D 6102 – Standard Guide for Installation of Geosynthetic Clay Liners

18. ASTM D 6243 – Standard Test Method for Determining the Coefficient of Soil and GCL or Geosynthetic and GCL Friction by the Direct Shear Method

19. ASTM D 6496 – Standard Test Method for Determining Average Bonding Peel Strength Between the Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners

20. ASTM D 6768 – Standard Test Method for Tensile Strength of Geosynthetic Clay Liners

21. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials

1.4 DEFINITIONS

A. Bentonite – Clay soils comprised primarily of sodium montmorillonite, characterized by high swelling potential and low hydraulic conductivity.

B. Construction Quality Assurance (CQA) Officer – The professional representative of the CQA monitoring firm shall be responsible for implementation of the CQA plan.

C. Geomembrane – An essentially impermeable membrane of high density polyethylene (HDPE) containing 2 to 3 percent carbon black or titanium dioxide for ultraviolet light resistance.

D. Geosynthetic Clay Liner (GCL) – Manufactured liner material consisting of a layer of granular bentonite affixed to a minimum average 30 mil thick smooth surface HDPE or LLDPE geomembrane liner by chemical adhesives.

E. Lot – Group of consecutively numbered rolls from the same manufacturing line.

F. Minimum Average Roll Value (MARV) – The minimum average value of a particular physical property of a material.

G. Overlap – The width of material of a GCL panel in contact with an adjacent GCL panel. The distance measures perpendicular from the overlying edge of one panel to the underlying edge of the other.

1.5 SUBMITTALS

A. LEED submittal requirements

1. For all installed products and materials of this section, complete the Materials Reporting Form (blank copy attached at end of Section 018113 Sustainable Design Requirements). Information to be supplied for this form shall include:

   a. Cost breakdowns for the materials included in the Contractor or subcontractor's work. Cost breakdowns shall include total installed cost and material-only cost.

   b. The percentages (by weight) of post-consumer and/or post-industrial recycled content in the supplied product(s).

   c. Indication of whether the manufacturing location of the supplied product(s) is within 500 miles of the project site.

   d. Indication of the exact distance (in miles) from the location of where the product(s) have been extracted, harvested or recovered, and manufactured.

2. For all field-applied adhesives, sealants, paints and coatings relating to work of this Section that are used on the interior of the building (defined as inside of the waterproofing system), complete the VOC REPORTING FORM (blank copy attached at end of Section 018113 Sustainable Design Requirements). For each product listed, indicate the Volatile Organic Compound (VOC) content in grams/liter or lbs/gallon.

3. Provide back-up documentation to validate information provided on the MATERIALS and VOC REPORTING forms, except Cost data. For each material listed on the Forms, provide documentation to certify each of the material attributes (e.g., recycled content, VOC content).

4. Provide cut sheets with the Contractor's or subcontractor's stamp, confirming that the submitted products are the products installed in the Project.

5. The LEED Submittal information outlined above shall be assembled into one (1) package per Specification section or subcontractor. Two (2) copies of the submittal are required. Incomplete or inaccurate LEED Submittals may be used as the basis for rejecting the submitted products or assemblies.

6. LEED Performance Requirements

   a. Material specified in this section shall contain recycled content, as available (the percentage of recycled content is based on the weight of the component materials). Certification and submittal of recycled content shall be in accordance with Division 1 General Requirements.

b. Materials fabricated within, and containing raw materials extracted within 500 miles of the project site shall be documented in accordance with Division 1 General Requirements.

B. Product Data: Submit the following to ENGINEER prior to shipping material to the site.

1. Geomembrane

a. Certification stating that the geomembrane meets the product requirements.

b. Copy of quality control tests performed by geomembrane supplier (if different from MANUFACTURER).

c. Copy of quality control tests performed by MANUFACTURER.

2. Bentonite

a. Certification stating that the bentonite meets the product requirements.
b. Copy of quality control tests performed by bentonite supplier (if different from MANUFACTURER).
c. Copy of quality control tests performed by MANUFACTURER.

3. GCL

a. Certification stating that the GCL meets the product requirements.
b. Copy of quality control tests performed by MANUFACTURER.
c. Permeability testing on typical product.
d. Laboratory test data on typical product for Free Swell (ASTM D 5890).

C. Qualifications (INSTALLER): Submit the name of INSTALLER, resume of installation supervisor/field engineer to be assigned to the project, and list of projects completed by INSTALLER that involved geomembranes supported GCLs.

D. Submit Quality Control Plan and Installation Procedures (MANUFACTURER) three (3) weeks prior to installation, including:

1. Copy of MANUFACTURER's quality control plan including list of quality control tests performed and typical testing frequencies.

2. Recommended installation procedures.

3. Panel layout drawing identifying panels and overlaps.

1.6 QUALIFICATIONS

A. INSTALLER shall meet the following requirements:

1. The contractor or subcontractor performing the work of this section must, within the last five (5) consecutive years prior to the bid opening, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work.

2. Installer shall have experience in constructing wetland lining/closure projects using GCL products.

1.7 QUALITY ASSURANCE

A. The Commissioner will engage the services of a CQA officer, and Construction Quality Assurance (CQA) Laboratory for monitoring the quality and installation of the GCL unless otherwise specified.

B. The INSTALLER shall aid the CQA officer in the product sampling by providing personnel and equipment necessary to move, cut and protect GCL rolls and panels.

1.8 DELIVERY, STORAGE AND HANDLING

A. General: Conform to the MANUFACTURER's requirements and ASTM D5888 unless otherwise specified.

B. Delivery

1. Deliver material to the site only after the CQA Officer accepts required submittals.

2. Material shall be covered with a waterproof, tightly-fitting, plastic covering resistant to ultraviolet degradation.

3. Ship less than one month prior to scheduled installation.

4. Each roll shall be marked with the following information:

a. manufacturer's name;

b. product identification;

c. lot or batch number;

d. roll number; and

e. roll dimensions

C. Storage

1. Store rolls in space allocated by ENGINEER. Space should be at high ground level or elevated above ground surface.

2. Stack no more than 3 rolls high.

3. Protect rolls from precipitation, other sources of moisture, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

4. Preserve integrity and readability of roll labels.

D. Handling

1. Use appropriate handling equipment to MANUFACTURER's recommendations to load, move, or deploy GCL rolls.

2. Handling of rolls shall be done in a competent manner such that damage does not occur to the product or to its protective wrapping. Follow handling procedures outlined in ASTM D 5888.

3. Damage to protective covering due to mishandling or sampling must be repaired immediately. Repairs shall be such that the GCL roll is protected from moisture or other deleterious conditions.

4. INSTALLER is responsible for off-loading, storage, and transporting material form storage area to installation site

1.9 MOCK UP

A. Wetland Liner shall be included in Mock Up. Mock Up shall be as determined by Commissioner and be approximately 2500 sq feet and located on the site. Mock Up shall be built at least 1 year prior to wetland cell system construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. GSE Environmental, LLC., Houston, TX
GundSeal Smooth HDPE Geosynthetic Clay Liner (GCL).

B. CETCO Lining Technologies, Hoffman Estates, IL
Bentomat ST Standard Reinforced GCL

C. Or approved equal.

2.2 GENERAL PROPERTIES

A. The GCL and its components shall exhibit properties and testing that meet or exceed the minimum average values shown in Table 1A.

B. No GCL shall be installed until the requirements of this Section have been met, and approval of Engineer has been obtained.

C. Overlap guideline, minimum 6 inches, shall be imprinted on one edge of the component of the GCL to be placed upward in the field as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible, non-toxic ink.

2.3 GEOMEMBRANE SUPPORTED GCL MATERIAL PROPERTIES

A. Meet the requirements of Table 1A or approved equal.

Table 1A: Geosynthetic Clay Liner (Smooth HDPE)

TESTED PROPERTY	TEST METHOD	FREQUENCY	MINIMUM AVERAGE VALUE					
FINISHED GCL PROPERTY			15 mil	20 mil	30 mil	40 mil	60 mil	80 mil
Bentonite Coating[1], lb/ft^2 (kg/m^2)	ASTM D 5993	1/40,000 ft^2 (1/4000 m^2)	≥ 0.75 (3.66)					
Effective Hydraulic Conductivity, m/s	ASTM D 5887/E 96	periodically	≤ 4 x 10^{-14}					
Bentonite Moisture Content	ASTM D 2216	1/40,000 ft^2 (1/4000 m^2)	25% Typical					
GEOMEMBRANE PROPERTY[2]								
Thickness, (minimum average) mil (mm) Lowest individual reading (-10%)	ASTM D 5199	1/100,000 ft^2 (1/10,000 m^2)	15 (0.40) 14 (0.34)	20 (0.50) 18 (0.45)	30 (0.75) 27 (0.69)	40 (1.00) 36 (0.91)	60 (1.50) 54 (1.35)	80 (2.00) 72 (1.80)
Density, g/cm^3	ASTM D 1505	1/200,000 ft^2 (1/20,000 m^2)	0.94	0.94	0.94	0.94	0.94	0.94
Tensile Properties Tensile Break Strength, lb/in (N/mm) GCL Tensile Strength[3], lb/in (N/mm) Elongation at Break, %	ASTM D 6693 ASTM D 6768 ASTM D 6693	1/200,000 ft^2 (1/20,000 m^2) 1/200,000 ft^2 (1/20,000 m^2) 1/200,000 ft^2 (1/20,000 m^2)	44 (7) 20 (3) 500	76 (12) 42 (7) 500	114 (20) 63 (11) 700	152 (26) 84 (15) 700	243 (42) 130 (23) 700	327 (57) 173 (30) 700
Puncture Resistance, lb (N)	ASTM D 4833	1/200,000 ft^2 (1/20,000 m^2)	20 (89)	36 (158)	54 (240)	72 (320)	108 (480)	144 (640)
SODIUM BENTONITE PROPERTY								
Hydraulic Flux: Bentonite, m^3/m^2/sec	ASTM D 5887	periodically	≤ 1 x 10^{-8}					
Hydraulic Conductivity, m/s	ASTM D 5887	periodically	≤ 1 x 10^{-8}					
Free Swell, ml/2 g	ASTM D 5890	1/60,000 lb (1/30,000 kg)	≥ 24					
Fluid Loss, ml	ASTM D 5891	1/60,000 lb (1/30,000 kg)	≤ 18					
TYPICAL ROLL DIMENSIONS								
Roll Width[4], ft (m)			17.5 (5.3)	17.5 (5.3)	17.5 (5.3)	17.5 (5.3)	17.5 (5.3)	17.5 (5.3)
Roll Length[4], ft (m)			200 (61)	210 (64)	180 (54)	180 (54)	180 (54)	150 (45)
Roll Area, ft^2 (m^2)			3,500 (325)	3,675 (341)	3,150 (286)	3,150 (286)	3,150 (286)	2,625 (244)
Roll Weight, lb (kg)			4,500 (2,050)	4,200 (1,900)	4,200 (1,900)	4,200 (1,900)	4,500 (2,050)	4,300 (1,950)

PART 3 EXECUTION

3.1 INSTALLATION

A. Examine substrates, with Installer present, for compliance with requirements for soil compaction and grading; for subgrade free from angular rocks, rubble, roots, vegetation, debris, voids, protrusions, and ground water; and for other conditions affecting performance of geomembrane liner.

B. Examine anchor trench excavation and concrete perimeter, where geomembrane liner will be secured, for substrate conditions indicated above and for correct location and configuration.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary ballast, until edges are permanently secured, that does not damage geomembrane liner or substrate, to prevent uplift of geomembrane liner in areas with prevailing winds.

B. Prepare surfaces of construction penetrating through geomembrane liner according to geomembrane liner manufacturer's written instructions.

C. Remove curing compounds and coatings from concrete surfaces to be sealed to geomembrane liner.

3.3 INSTALLATION

A. General: Place geomembrane liner over prepared surfaces to ensure minimum handling. Install according to Shop Drawings and in compliance with geomembrane liner manufacturer's written instructions. Begin placing geomembrane liner at Project's upwind direction and proceed downwind. Install geomembrane liner in a relaxed condition, free from stress and with minimum wrinkles, and in full contact with subgrade. Do not bridge over voids or low areas in the subgrade. Fit closely and seal around inlets, outlets, and other projections through geomembrane liner. Permanently secure edges.

B. Field Seams: Comply with geomembrane liner manufacturer's written instructions. Form seams by lapping edges of panels 2 to 4 inches unless instructions require a larger overlap. Wipe contact surfaces clean and free of dirt, dust, moisture, and other foreign materials. Use solvent-cleaning methods and grind geomembrane seam surfaces if recommended by geomembrane liner manufacturer. Proceed with seaming at required temperatures for materials and ambient conditions. Continuously bond sheet to sheet to construct single or double seams of width recommended for method of seaming used. Seal or fuse free seam edges. Inspect seams and reseal voids.

1. Use bonding technique recommended by geomembrane liner manufacturer. Apply pressure to smoothly bond surfaces together. Examine for and patch wrinkles and fishmouths.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective work where possible to eliminate functional and visual defects; where not possible to repair, replace wetland liner.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that wetland liner is without damage or deterioration at the time of Substantial Completion.

B. Repair or replace areas of geomembrane liner damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.

C. Before initial filling of pond or placement of earth cover, inspect seams and patched areas to ensure tight, continuously bonded installation. Repair damaged geomembrane and seams and re-inspect repaired work.

3.6 MATERIAL INSTALLATION PROCEDURES

A. General: The GCL installation should follow general guidelines provided by ASTM D 6102 unless otherwise specified.

3.7 PREPARATION OF FOUNDATION LAYER SURFACE

A. The foundation soil layer surface shall be rolled to a smooth level surface, be free of stones typically greater than 0.50 inch diameter, and prepared as otherwise specified in Section 312000 – Earthwork.

3.8 GCL PLACEMENT

A. Once the subgrade is accepted by the INSTALLER and approved by ENGINEER, GCL rolls shall be delivered to the working area in their original packaging. Immediately prior to deployment, the packaging shall be carefully removed without damaging the GCL. The GCL shall be placed such that the geomembrane side of the GCL faces upward.

B. Equipment used to deploy the GCL must be track or rubber tired with 40 psi (2 kPa) maximum ground pressure and is subject to approval by the ENGINEER. Equipment shall not cause rutting of the subgrade surface, shall not make sharp turns, and shall not be driven over the GCL, unless proper demonstration of GCL survivability and approval of ENGINEER can be obtained. Any damage to the subgrade or the GCL shall be the responsibility of the CONTRACTOR to replace or put back to the pre-installation conditions.

C. Care shall be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the GCLs bentonite surface. A temporary geosynthetic subgrade covering slip sheet or rub sheet may be used, as necessary, to reduce friction damage during placement.

D. Care shall be taken to not entrap objects or moisture beneath the GCL.

E. The individual deployed rolls (panels) shall be placed so that overlapping edges are parallel to the direction of the slope. The panels shall be placed to ensure a minimum overlap of minimum 6 inches between panels.

F. All GCL shall be placed and maintained flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels.

G. All exposed bentonite (product deployed bentonite side up) GCL panels shall be covered the same day as they are deployed with a geomembrane or equivalent.

H. Product deployed geomembrane side up, bentonite side down, shall be ultimately covered with a minimum12 inches thick layer of cover soil within one week of deployment.

I. If the bentonite becomes hydrated before the cover soil layer is placed, it shall be tested and replaced, as necessary, to meet the specified maximum allowable moisture contents listed (generally $\leq 30\%$).

J. On the side slopes, the GCL shall first be anchored securely, at the top of the slope, and then deployed down the slope in a controlled continuous manner. The GCL shall extend continuously from the top to the toe of the slope unless otherwise directed by the CQA Monitor.

K. During windy conditions, the GCL edges shall be weighted down, if necessary, with a sufficient number of filled sandbags or underlying soil material to prevent damage to the GCL.

L. The GCL material shall be cut with a sharp utility knife with a hook blade, or other approved device. Do not damage adjacent or underlying materials while cutting the GCL.

M. The INSTALLER shall examine the GCL surface and remove any harmful foreign objects.

N. Do not install GCL during periods of rain or in areas of ponded water or unusually moist soils.

3.9 GCL PLACEMENT

A. The minimum dimension of the longitudinal overlap shall be 6 inches. End-of-roll overlapped seams shall be similarly constructed, with a minimum overlap of 12 inches in all directions. Do not sew or use mechanical connections to hold the panels together. No additional granular bentonite is required for the GCL overlap areas.

B. Seams at the ends of the panels shall be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone.

3.10 DETAIL WORK

A. The GCL shall be sealed around any penetrations and embedded structures in accordance with the Construction Drawings and the GCL MANUFACTURER's recommendations.

3.11 DEFECTS AND DAMAGE REPAIR

A. If the GCL is defective or damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged

area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 inches is achieved around all of the damaged area. The patch shall be placed with the bentonite side down. Adhesion tape may be used to hold the patch in place, while cover soil is being placed.

3.12 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. General

1. Field quality control is the responsibility of the INSTALLER. The INSTALLER must document that the installation proceeds in accordance with the requirements of this Specification Section.

2. Field construction quality assurance (CQA) is the responsibility of the Commissioner's authorized representatives who shall be assisted by the INSTALLER. CQA consists of inspections, field-testing, laboratory testing, and record keeping.

B. During Installation, the INSTALLER, along with the Commissioner's authorized CQA representatives, shall inspect:

1. Material Storage and Handling: Verify that the material is carefully unloaded and protected against ground moisture, rainfall, and other damaging conditions. Material should be stored and handled in accordance with ASTM D 5888. Wetland liner rolls should be stored in a well-drained area and covered with a tarpaulin or equivalent until the time of deployment.

2. Bentonite Moisture Content: Verify that the delivered product has a moisture content less than the maximum allowed by project specifications. If not otherwise specified, the bentonite coating of wetland liner should have a moisture content up to approximately 30% during installation and soil covering activities. The bentonite can be air-dried or sun-dried just prior to installation if necessary for localized areas of elevated bentonite moisture or hydration. Hydrated areas of bentonite should be covered with wetland liner patch or, alternately, removed.

3. Subgrade: Verify that the subgrade is relatively smooth and uniform. The subgrade should be free of any objects greater than 0.75 inch unless otherwise specified. Final preparation of the subgrade surface may include smooth grading and/or smooth drum rolling the surface. Any surface objects greater than 0.75 inch should be removed by scarifying the surface by manually removing unsuitable objects.

4. Overlapped Seams: Verify that the material is installed and aligned with the proper overlap distance between panels. Minimum standard lengthwise overlap distance is 6 inches and minimum standard widthwise overlap distance is 1 foot. Overlap distance should be adjusted for site specific subgrade conditions. Welded Geomembrane Seams. When the wetland liner geomembrane backing seams are fusion or extrusion welded, standard installation procedures, CQA practices, and seam testing procedures should be utilized as outlined in the *GSE Geomembrane Installation Quality Assurance Manual.*

5. Bentonite Prehydration: For applications that require prehydration of the bentonite at seam overlap areas and adjacent to structures, ensure the bentonite is adequately prehydrated. This should be accomplished by unfolding and exposing overlap

seam areas and structures after the material is installed and subsequently liberally spraying the bentonite coating with tap water. In addition to spraying the bentonite coating of exposed contact areas, the structure surface and overlap geomembrane backing should also be prehydrated as the bentonite coating of the GCL. Compatibility of the bentonite with the hydrating liquid (other than tap water) should be verified with a bentonite free swell test (ASTM D 5890 or a simplified variation).

6. Repairs and Patches: Verify that the installed material is not damaged. For isolated areas where the geomembrane backing is punctured or torn, or where the bentonite coating has been dislodged during installation, the area should be patched. Patches with wetland liner should be placed over the damaged area with the bentonite coating directly against the damaged area. Patches should extend a minimum 1 foot outward around the perimeter of the damaged area.

7. Dislodging of the Bentonite Coating: Verify that the wetland liner product is deployed and covered in a manner that does not scrape or dislodge the bentonite coating. To add protection to the bentonite layer of wetland liner, a thin spunbonded geotextile is attached to the bentonite surface to minimize the potential for dislodging and/or scraping the bentonite layer during installation. In areas where the bentonite coating has been scraped or dislodged, bentonite should be replaced by patching the affected area. For dislodged bentonite at roll edges resulting from material handling, the overlap distance should be increased to account for the bentonite loss.

8. Debris in the Overlapped Seams: Verify that no soil or other debris migrates into wetland liner overlap seams, or between wetland liner and the overlying geomembrane in an encapsulated mode.

9. Material Wrinkles and Fishmouths: Verify that the deployed wetland liner liner does not contain wrinkles or fishmouths. Wrinkles that cannot be pulled out manually should be (1) patched or (2) cut out and the area subsequently patched. Patches are made from the same base wetland liner material with the same specified overlap distances extending around the affected area(s).

10. Attachment to Structures: Verify the material is attached to structures (such as pipes, concrete foundations, and steel tanks) in accordance with the manufacturer's recommendations.

11. Material Anchorage at Slopes: Verify the material is properly anchored adjacent to slopes in accordance with the project design details.

12. Bentonite Protection Deployed Bentonite Side Up: When wetland liner is installed in an encapsulated mode (e.g., deployed with the bentonite side up with a separate overlying geomembrane), verify that all exposed bentonite is covered with the overlying geomembrane at the end of each workday. This will effectively protect the bentonite from premature hydration from stormwater run-off. The overlying geomembrane should be secured with ballast sandbags, or equivalent, around the perimeter of the wetland liner panel.

13. Bentonite Protection Deployed Bentonite Side Down: When wetland liner is installed bentonite side down (geomembrane side up), no additional daily covering is necessary to protect the bentonite. Caution should be taken, however, to protect

the exposed perimeter panel edges from water pooling and subsequently flowing below the liner. This can be accomplished by confirming the perimeter of the deployed wetland liner material lies flat and in intimate contact with the subgrade soil by manually adjusting material. Alternately, temporary ballast, such as sandbags or soil, may be placed on top of the wetland liner material in areas to prevent material bridging over the subgrade.

C. During soil cover operations, the INSTALLER, along with the Commissioner's authorized CQA representatives, shall inspect:

1. Material Inspection: The Commissioner's authorized CQA representatives shall inspect each panel of GCL placed before the GCL is covered.

2. General Soil Cover Operations: Verify that wetland liner is covered with soil

   1). in a timely manner,
   2). in a careful manner, and
   3). with adequate soil thickness $\geq$1 foot

3. Subgrade Moisture Conditions: The following general recommendations are provided for moisture characteristics of soils, the intent being to cover the wetland liner before bentonite migration/displacement due to construction would cause concern:

   a. If the subgrade is relatively dry (approaching the "wilting point" moisture content that makes it difficult for vegetation to grow), wetland liner should be covered within five days.

   b. If the subgrade is damp to moist (approaching the "field capacity" moisture content that allows lush vegetation), wetland liner should be covered within three days.

   c. If the subgrade is moist to wet (approaching saturation), it is advisable to cover wetland liner by the end of the following day.

4. CQA Observation of Soil Cover Operations: Verify that the soil spreading operations are performed in accordance with the specifications and do not cause damage to the lining system.

5. Contractor Observation of Soil Cover Operations: In the absence of CQA monitoring during soil cover operations, the contractor performing soil covering should provide a ground person in front of the spreading activities at all times. The primary responsibility of the ground person is (a) to establish and maintain adequate grade control of the cover soil layer, (b) to manually reduce or flatten wrinkles in the installed liner in advance of soil spreading, and (c) to identify and caution against any potential damage to the lining system.

D. The INSTALLER and the OWNER's authorized CQA representatives shall verify proper installation procedures are followed for all other specified installation precautions.

E. The INSTALLER shall aid the Commissioner's authorized CQA representatives in collecting samples for testing as follows:

1. According to the requirements of the CQA Plan.

2. Each conformance sample shall be a minimum of 2 feet long and run the entire width of the roll.

3. Under direction of the Commissioner's authorized CQA representatives, the INSTALLER shall mark the roll number and machine direction on each sample.

F. Field Testing:

1. The Commissioner's authorized CQA representatives shall conduct the following conformance tests:

   a. moisture content (ASTM D 2216)
   b. mass per unit area (ASTM D 5993)

2. Reported values shall be the average of 5 specimens taken from the sample.

3. If field testing passes (meets the requirements of Table 1), the remaining portion of the sample shall be sent to the CQA laboratory.

G. Laboratory Testing:

1. The following laboratory tests shall be conducted on samples passing field testing:

   a. moisture content

   b. mass per unit area (bentonite)

   c. thickness (geomembrane only)

   d. permeability (one test only on bentonite for the entire project) or fluid loss

H. In-place moisture content

1. Samples of delivered GCL will be collected and tested for moisture content at the rate of 1 sample per 100,000 square feet.

2. This rate of sampling may be increased, at the discretion of the Commissioner's authorized CQA representatives.

3. The Commissioner's authorized CQA representatives will take samples.

4. Samples shall be minimum of 4 inches x 4 inches roll width.

5. The average moisture content should be 25% (as delivered to the site) and less than 30% during installation minus adhesive content, prior to completed placement of the final cover soil or panel sections will be unconditionally rejected and:

   a. Bentonite portion allowed to sun dry or mechanically dried to the proper moisture content

   b. New samples will be taken 50 feet in either direction along the roll length (or at the end of the roll, if less than 50 feet away).

   c. The entire 100 feet long section of the roll between the new samples will be removed and replaced, following manufacturer's recommended repair procedure). The Commissioner's authorized CQA representatives shall determine the width of the removed segment.

3.13 GCL ACCEPTANCE

A. The INSTALLER shall retain ownership and responsibility of the GCL until the ENGINEER accepts it.

B. The ENGINEER will accept the GCL installation after:

1. All required documentation from the MANUFACTURER and INSTALLER has been received and accepted.

2. Test reports verifying material properties have been received and accepted by the Commissioner's authorized CQA representatives.

3. The Commissioner's authorized CQA representatives have completed final inspection and confirms that all noted defects have been repaired.

END OF SECTION 334713

This Page Intentionally Left Blank

Geotechnical Data Report

on

Subsurface Exploration for

The Croton Water Treatment Plant

at Mosholu Golf Course, Van Cortlandt Park,

Borough of the Bronx, City of New York

Volume 1
Report

City of New York
Department of Environmental Protection
Bureau of Environmental Engineering

November 2000

Metcalf & Eddy of New York, Inc. – HAZEN AND SAWYER, P.C.

A Joint Venture

TABLE OF CONTENTS

Page

VOLUME 1 - REPORT

1. **Introduction** 1

   1.1 Purpose 1
   1.2 Background 1
   1.3 Existing Geologic Conditions 2
   1.4 Exploration Program 3

2. **Subsurface Exploration Program** 5

   2.1 Test Borings 5
   2.2 Air Track Borings 11
   2.3 Test Pits 11
   2.4 In-situ Testing 11
   2.5 Materials Testing 15
   2.6 Groundwater Quality Analysis 16

3. **Conclusions** 20

4. **Limitations** 21

   4.1 Subsurface Information 21
   4.2 Applicability of Report 22
   4.3 Reinterpretation of Recommendations 22
   4.4 Use of Report by Prospective Bidders 23

TABLE OF CONTENTS (continued)

VOLUME 2 – APPENDICES

APPENDIX A - Test Boring Logs

APPENDIX B - Air Track Boring Data

APPENDIX C - Test Pit Logs

APPENDIX D - Oriented Core Measurements

APPENDIX E - Piezometer and Monitoring Well Logs

APPENDIX F - Piezometer and Monitoring Well Readings

APPENDIX G - Falling Head Test Data

APPENDIX H - Packer Test Data

APPENDIX I - Slug Test Data

APPENDIX J - Laboratory Soil and Rock Test Results

APPENDIX K - Groundwater Quality Analysis

TABLE OF CONTENTS (continued)

LIST OF TABLES

Table		Page
2-1	Subsurface Exploration Summary	6
2-2	Piezometers and Monitoring Well Data	10
2-3	Falling Head Tests	13
2-4	Packer Tests	14
2-5	Soil Tests	17
2-6	Rock Tests	18

LIST OF FIGURES

Figure		
1-1	Test Boring, Air Track Boring and Test Pit – Location Plan	24

REPORT

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 1
INTRODUCTION

1.1 PURPOSE

This Report describes the subsurface exploration program for the design of the Croton Water Treatment Plant, which will be located at the Mosholu Golf Course Driving Range in Van Cortlandt Park, Borough of the Bronx, City of New York.

1.2 BACKGROUND

The Croton water system is the earliest developed of the three New York City upland water supplies. Water is drawn from the Croton Lake Gate House and discharged into the New Croton Aqueduct for transmission to New York City. Water flows by gravity though the aqueduct to Jerome Park Reservoir, a distribution reservoir in the Borough of the Bronx, where Croton water enters the New York City distribution system.

The Mosholu Golf Course Driving Range was selected in December 1998 from eight alternative sites by the NYC Department of Environmental Protection to be the location of the Water Treatment Plant for treating the Croton water supply. The Golf Course, owned by NYC Department of Parks and Recreation, is located in the southeastern corner of Van Cortlandt Park.

The course was established and created from park land in 1914, and is currently being leased to a private concessionaire. In 1989, the original 18-hole golf course was re-landscaped and opened as a 9-hole course with a practice driving range. The Water Treatment Plant along with Raw Water, Finished Water and Backwash Pumping Stations and a Treated Water Reservoir will all be located beneath the Driving Range.

1.3 EXISTING GEOLOGIC CONDITIONS

The Borough of the Bronx is located in the Manhattan Prong Portion of the New England Upland Physiographic Province and underlain by tightly folded Pre-Cambrian metamorphic rock formations. The topography in this area is largely a product of preglacial stream erosion, modified somewhat by glacial erosion and deposition. It is mainly characterized by parallel, linear ridges and valleys having a northeasterly trend. The oldest formation is the Fordham Gneiss, a nearly-massive banded rock of complex composition and structure, which generally underlies the areas of high reliefs in the western portion of the Bronx where the Mosholu Golf Course is located. The other formations in the Bronx are the Inwood Marble, which, in the western portion, underlies the low areas, and the Manhattan Schist, which underlies the eastern two-thirds of the borough. These latter two formations are not present at the Project site.

Generally, the Fordham Gneiss Formation is exposed or is relatively close to the surface, overlain by Upper Pleistocene deposits. These deposits consist chiefly of glacial fluvial stratified sediments, largely outwash sand and gravel that have accumulated in depressions on the bedrock, locally including beds of reddish silt, as well as of unstratified drift deposited as ground moraine (till) over the bedrock or stratified deposits of outwash. Weathering has locally affected the upper bedrock portion, forming a saprolitic horizon (decomposed rock) above the partly weathered or unweathered bedrock. Saprolite can be described as a dense, soil-like material grading from silts to sands, where relict rock structures are retained with less than 10 percent corestones, and is often micaceous. Since the till and saprolitic materials are often difficult to differentiate in samples recovered by subsurface drilling, they are commonly considered as a single unit for design purposes.

1.3.1 Existing Site Features

At the Mosholu Golf Course, bedrock belonging to the Fordham Gneiss Formation is present beneath the outwash soil and till layers over all of the project site. The site consists of gentle slopes on the driving range with large tracts of woodland areas along

the perimeter. In general, the subsurface conditions at the site can be summarized as follows:

- Surficial Soils. These soils consist of 0 up to 34 feet of silty sand, with occasional sandy silt and boulders, variable in color, and their consistency varies, in general, from loose to medium dense (SM, SP-SM, 6-65 and 7-65 soil classes as per the New York City Building Code Numerical Classification System). They also may include organic matter and a few boulders in the upper 2 feet (Class 11-65).
- Glacial Soil. A medium dense to very dense glacial till consisting of well graded silty sand, gravel, cobbles, and boulders (SM and GM, SP-SM and GP-GM, Classes 6-65 and 6-65/5-65), generally underlies the surficial soils. Imported fill or reworked till may overlay the till.
- Saprolitic Soil. Pockets of dense to very dense saprolite as thick as 10 feet are locally encountered above the partly weathered or unweathered bedrock.
- Bedrock. The overburden soils described above are underlain by bedrock from the Fordham Gneiss Formation, consisting of a foliated light-to-medium gray muscovite-biotite- plagioclase-quartz-gneiss locally transitioning to an amphibolitic or a quartz-banded gneiss, which is weathered and fractured at various degrees and depths. The depth to bedrock varies from 4 to 40 feet, averaging 15 feet. Typically, bedrock quality improves with depth, achieving Class 2-65 to 1-65.

1.4 EXPLORATION PROGRAM

The subsurface exploration program consisted of 51 test borings, 35 air-track borings, and 10 test pits. The location of the test borings, air track borings and test pits are shown on Figure 1-1 bound at the end of the Report. Air track borings were performed to provide additional bedrock elevations between the test borings. Standard operating procedures were established for soil borings, rock coring, soil permeability testing and rock water pressure testing to ensure that each drill crew would follow the same drilling and field testing procedures. The drilling work performed by Warren George Inc., Jersey

City, New Jersey, commenced on January 25, 1999 and ended on March 18, 1999 under the supervision of the Joint Venture personnel.

In order to complete the exploration program on schedule, three to five drill rigs were generally employed at the site. Of the 51 borings completed, 6 boreholes were drilled at a 60° angle (from horizontal). In addition, 8 borings utilized oriented-rock coring techniques. Fifteen piezometers with porous points and one monitoring well with a well screen were completed. Three boreholes contain double piezometers with the porous points installed at different elevations in order to verify groundwater continuity between the overburden soil and bedrock.

The soil samples and rock cores recovered during the exploration program are presently stored in the Jerome Pumping Station, Bronx, New York.

SECTION 2

SUBSURFACE EXPLORATION PROGRAM

2.1 TEST BORINGS

The exploration program included drilling 51 borings and associated in-situ and laboratory testing of the soil and rock. The borings generally extended 10 feet below proposed subgrade with a minimum of 5 feet into competent rock. The test boring logs are presented in Appendix A of this Report. Specifically, the drilling program was planned to obtain information on:

- The depth and quality of bedrock in the area of the proposed Water Treatment Plant;
- The nature and extent of the overburden materials encountered;
- The permeability of the overburden soil and rock mass;
- The groundwater conditions and gradient;
- The variation in the strength of the rock mass;
- The orientation of the foliation and joints in the rock mass.

A summary of the subsurface exploration including the location, elevation, depth and in-situ tests performed in each boring is presented in Table 2-1.

2.1.1 Soil Samples

The borings were advanced using standard geotechnical procedures. A 4-inch casing was typically driven or spun to the sampling depth and cleaned out with a tricone roller bit. Standard 2-foot long split spoon samples were obtained continuously to 10 feet starting at the ground surface and every 5 feet thereafter, to the top of rock in accordance with ASTM Standard D-1586. The number of blows required to drive the sampler each 6-inch interval was recorded over a depth of 2 feet for each soil sample taken. All samples were

TABLE 2-1

Subsurface Exploration Summary

1999

Borehole	Date Started	Date Finished	Elevation (FT)	Northing (FT)	Easting (FT)	Total Depth (FT)	Overburden Thickness* (FT)	Elevation of Top of Bedrock (FT)	Piezo-meter	Oriented Core Measure ments	Packer Test	Falling Head Test	Slug Test
MG-B1-99	16-Feb	17-Feb	188.36	322,939.04	624,346.55	95	13.00	175.36					
MG-B2-99	4-Mar	10-Mar	194.63	323,039.00	624,359.03	150	11.00	183.63	Yes	Yes	Yes	Yes	
MG-B3-99	19-Feb	24-Feb	197.03	323,138.09	624,368.95	150	11.00	186.03					
MG-B4-99#	25-Feb	26-Feb	198.82	323,241.02	624,352.78	91.12	13.00	185.82					
MG-B5-99	4-Mar	8-Mar	199.49	323,336.35	624,394.20	75	13.00	186.49	Yes	Yes	Yes	Yes	
MG-B6-99	19-Feb	22-Feb	195.84	323,437.24	624,405.81	78	13.00	182.84					
MG-B7-99	16-Feb	17-Feb	193.46	322,927.76	624,444.51	85	14.00	179.46					
MG-B8-99	17-Feb	19-Feb	195.92	323,075.62	624,463.08	84	6.00	189.92					
MG-B9-99	15-Feb	16-Feb	198.13	323,275.41	624,486.52	88	13.00	185.13					
MG-B10-99	18-Feb	19-Feb	193.13	323,422.92	624,505.15	78	8.00	185.13					
MG-B11-99	12-Mar	16-Mar	194.92	322,906.15	624,542.71	91.12	8.67	186.25					
MG-B12-99	16-Feb	17-Feb	195.19	323,064.12	624,562.82	81.5	12.00	183.19					
MG-B13-99	10-Feb	11-Feb	195.97	323,264.15	624,587.04	83	7.00	188.97					
MG-B14-99	1-Mar	3-Mar	190.53	323,436.44	624,605.98	91.12	7.81	182.72					
MG-B15-99	10-Feb	11-Feb	195.56	322,903.09	624,644.07	81	11.00	184.56					
MG-B16-99	8-Feb	9-Feb	194.87	323,151.70	624,674.92	80	9.50	185.37					
MG-B17-99	25-Feb	2-Mar	192.33	323,420.47	624,708.49	74	4.00	188.33	Yes	Yes	Yes		
MG-B18-99	26-Feb	2-Mar	194.72	322,893.84	624,742.15	80	15.00	179.72	Yes	Yes	Yes		
MG-B19-99	12-Feb	15-Feb	195.57	323,040.23	642,760.57	83.5	8.50	187.07					
MG-B20-99	5-Feb	8-Feb	190.94	323,238.98	624,785.45	78	8.00	182.94					
MG-B21-99	22-Feb	24-Feb	190.53	323,387.65	624,803.10	72	3.00	187.53					
MG-B22-99	9-Feb	10-Feb	193.22	322,879.17	624,842.21	83	28.00	165.22					
MG-B23-99	3-Mar	4-Mar	192.34	323,124.25	624,872.68	80	14.00	178.34	Yes		Yes		
MG-B24-99	23-Feb	24-Feb	185.74	323,401.34	624,904.28	65	11.00	174.74					
MG-B25-99	24-Feb	25-Feb	181.35	323,596.59	624,955.96	35	11.60	169.75					
MG-B26-99	5-Feb	8-Feb	191.48	322,869.32	624,941.05	75.5	40.50	150.98					
MG-B27-99	3-Feb	4-Feb	192.16	323,016.09	624,959.81	77	26.00	166.16					
MG-B28-99	3-Feb	4-Feb	188.28	323,214.78	624,983.06	66	21.00	167.28					
MG-B29-99	9-Mar	11-Mar	181.72	323,392.71	625,005.14	65	10.00	171.72	Yes	Yes	Yes		
MG-B30-99	17-Feb	24-Feb	193.87	322,855.72	625,040.73	75	30.50	163.37	Yes	Yes	Yes	Yes	
MG-B31-99	1-Feb	2-Feb	188.34	323,103.27	625,070.95	75.5	20.50	167.84					
MG-B32-99	3-Mar	4-Mar	180.87	323,378.75	625,106.97	60	15.00	165.87				Yes	
MG-B33-99	25-Feb	25-Feb	173.13	323,679.09	625,141.00	30	20.00	153.13					
MG-B34-99	9-Feb	10-Feb	187.81	322,813.48	625,136.85	91.12	22.56	165.25					
MG-B35-99	1-Feb	2-Feb	183.24	322,992.78	625,158.76	65	21.00	162.24					
MG-B36-99	25-Feb	26-Feb	182.43	323,190.06	625,183.92	61	16.00	166.43	Yes		Yes	Yes	
MG-B37-99	10-Mar	16-Mar	175.48	323,357.28	625,222.24	91.12	18.22	157.26					
MG-B38-99	22-Feb	23-Feb	176.99	323,518.56	625,223.15	20	7.00	169.99	Yes				
MG-B39-99	2-Feb	4-Feb	179.20	322,835.71	625,248.43	65.5	16.00	163.20					
MG-B40-99	28-Jan	29-Jan	177.77	323,081.15	625,270.16	61	11.50	166.27					
MG-B41-99	27-Jan	27-Jan	177.25	323,329.79	625,288.24	25	4.00	173.25					
MG-B42-99	11-Feb	16-Feb	174.93	322,831.98	625,338.22	60	15.00	159.93	Yes	Yes	Yes		
MG-B43-99	28-Jan	29-Jan	174.84	322,918.19	625,351.04	56	17.00	157.84					
MG-B44-99	4-Feb	5-Feb	174.13	323,014.73	625,391.41	91.12	16.48	157.65					
MG-B45-99	8-Feb	10-Feb	176.79	323,116.71	625,375.14	55	14.50	162.29	Yes	Yes	Yes		
MG-B46-99	25-Jan	26-Jan	175.44	323,215.85	625,387.39	50	14.00	161.44					
MG-B47-99	25-Jan	26-Jan	172.97	323,321.30	625,396.15	20	15.00	157.97					
MG-B48-99	28-Jan	1-Feb	179.30	322,750.80	625,279.85	70	23.00	156.30					
MG-B49-99	10-Feb	11-Feb	194.48	322,798.68	624,883.11	75	34.00	160.48					
MG-B50-99	12-Feb	15-Feb	193.62	322,846.45	624,486.32	80	7.00	186.62	Yes		Yes		
MG-B51-99	17-Mar	18-Mar	166.78	323,583.36	625,500.11	22	17.00	149.78	Yes			Yes	Yes

* Overburden includes topsoil or asphalt

60-degree angle boring, all depths and elevatons corrected to vertical

Note: All elevations presented refer to the mean sea level at Sandy Hook, NJ, as established by the US Coast and Geodetic Survey

the Unified Soil Classification and the New York City Building Code Numerical Classification System (Sections 27-675 and 27-678, Table 11-2).

2.1.2 Rock Cores

Continuous NQ-size rock cores (1 7/8-inch sample diameter) were recovered in bedrock. The depth to bedrock and the amount of rock cored are shown in Table 2-1. Generally, 10-foot double tube core barrels were used. The percent recovery and Rock Quality Designation (RQD) were also calculated for each core run. The rock core obtained from the borings were described in detail and classified using the New York City Building Code Numerical Classification System (Sections 27-675 and 27-678, Table 11-2). Description and classification of recovered rock cores were based on the following criteria: recovery, RQD, fracture spacing, hardness of the rock and degree of weathering. Generally, the core recovery and RQD throughout the site was good to very good.

Six boring were completed at a 60° angle (from horizontal). In addition, 8 borings were completed using oriented-rock coring procedures in order to determine the strike and dip of the foliation and joints within the core.

2.1.3 Oriented Cores

Oriented cores were recovered during the exploration program in order to determine the joint trend at the Croton Water Treatment Plant site. Approximately 300 feet of oriented core were recovered from eight borings. The information from the oriented cores was plotted on a lower hemisphere projection of an equal area stereonet. A contour of the poles to the joint/foliation planes is shown on the attached figure in Appendix D.

The contour plot shows concentrations of northwesterly trending joints. There is a set of joints trending approximately N60°W, dipping approximately 60° either to the northeast or southwest. There is another group of joints striking N78°W, with a dip of 66° to the northeast.

The oriented core information, as well as the boring logs, indicate that there are numerous shallow dipping joints. As per the oriented core information, this low angle joint set strikes due east with a dip of 15° to the north.

Another concentration of data presented on the contour plot identify a joint set trending N28°E dipping 72° degrees to the northwest.

In summary, the plot indicates a predominance of jointing trending northwesterly, as well as additional sets of joints with the following trend:

N90°E	15°N
N60°W	58°NE
N62°W	60°SW
N78°W	66°NE
N28°E	72°NW

The boring logs indicated that the dip of the foliation varies. Reconnaissance mapping of rock outcrops along the Mosholu Parkway approximately one-half mile from the site indicates that the jointing parallel to the foliation trends approximately N18°W and dips at 80° to the northeast.

2.1.4 Piezometers and Monitoring Wells

A total of 15 piezometers and one monitoring well were installed during the investigation. The piezometers consisted of a 2-foot porous point groundwater intake placed at specific elevations, usually at the proposed elevations of the treatment plant foundations. Three of the 15 piezometers consisted of two porous points set at different elevations in order to verify the relationship of the groundwater encountered in the soil to the groundwater encountered in the bedrock. A monitoring well was constructed next to the wetland area for soil permeability testing. A summary of piezometer and monitoring

well construction data is presented in Table 2-2, Piezometers and Monitoring Wells. The piezometer and monitoring well as-built construction logs are presented in Appendix E.

The piezometers and the monitoring well were installed in selected boreholes upon completion of the borings. The selected boreholes were backfilled with grout to the appropriate depth as required, and a porous point (for the piezometers) or a well screen (for the monitoring well) and risers were placed down the hole. The annular space around the porous point or screen was backfilled with clean sand to two feet above the porous point or screen. A two-foot bentonite seal was placed above the sand and a one-foot pea gravel layer was placed above the seal. The remaining portion of the hole was backfilled with cement grout. The surface casing was sealed into place with a cement and sand mixture. Flush mount casings were installed for the piezometers and the observation well.

Water levels in the piezometers and the monitoring well were obtained weekly during the exploration period. The water level data are presented in Appendix F. The piezometers and the monitoring well were left in place to provide a means for future monitoring of the groundwater table. It is planned to take water level readings approximately once monthly during the design phase of the project.

2.1.5 Grouting of Boreholes

All boreholes, except those completed as piezometers or monitoring wells, were backfilled with cement grout. The majority of the boreholes were not grouted immediately, in order to allow the measurement of water levels after the boring work in the area had been completed. Groundwater measurements were taken from open boreholes generally 1-2 days after completion.

All boreholes were grouted using a Portland cement-bentonite grout of consistency comparable to that of the adjacent soil in overburden and of stiffer consistency in bedrock. The grout was placed in the borehole by tremie method.

TABLE 2-2

PIEZOMETERS AND MONITORING WELL DATA

PIEZOMETERS

Borehole No.	Porous Point Depth (FT)		Porous Point Elevation (FT)		Installation Medium
MG-B2S-99	82.0	84.0	112.63	110.63	Bedrock
MG-B2D-99	147.0	149.0	47.63	45.63	Bedrock
MG-B5-99	72.0	74.0	127.49	125.49	Bedrock
MG-B17-99	66.5	68.5	125.83	123.83	Bedrock
MG-B18-99	10.0	12.0	184.72	182.72	Soil
MG-B23-99	66.5	68.5	125.84	123.84	Bedrock
MG-B29-99	53.0	55.0	128.72	126.72	Bedrock
MG-B30S-99	30.0	32.0	163.87	161.87	Soil
MG-B30D-99	68.0	70.0	125.87	123.87	Bedrock
MG-B36S-99	14.0	16.0	168.43	166.43	Soil
MG-36D-99	56.5	58.5	125.93	123.93	Bedrock
MG-B38-99	16.0	18.0	160.99	158.99	Soil/Bedrock Interface
MG-B42-99	50.0	52.0	124.93	122.93	Bedrock
MG-B45-99	51.0	53.0	125.79	123.79	Bedrock
MG-B50-99	68.0	70.0	125.62	123.62	Bedrock

MONITORING WELL

Borehole No.	Well Screen Depth (FT)		Well Screen Elevation (FT)		Installation Medium
	From	To	From	To	
MG-B51-99	8.0	16.0	158.78	150.78	Soil
MG-B52-99	6.0	16.0	157.71	147.71	Soil
MG-B53-99	5.0	9.5	169.56	165.06	Soil
MG-B54-99	5.5	15.5	158.15	148.15	Soil
MG-B55-99	4.0	10.0	183.85	177.85	Soil

Notes:

1) S Refers to the higher porous point elevation within the boring

D Refers to the lower porous point

2) All elevations presented refer to the mean sea level at Sandy Hook, NJ, as established by the US Coast and Geodetic Survey

2.2 AIR TRACK BORINGS

Air Track borings were performed to provide additional bedrock elevation data between scheduled borings. A total of 35 Air Track borings were completed using a pneumatic rock drill mounted on a tractor chassis. Their locations are shown on Figure 1-1 bound at the end of this Report. The rock drill would penetrate through the soil until a hard surface was encountered. Drilling was extended a minimum of 5 feet into the hard surface to ensure bedrock was encountered and not a boulder. The Air Track boring data are presented in Appendix B.

2.3 TEST PITS

A total of ten test pits were excavated by a backhoe as part of the exploration program. Their locations are shown on Figure 1-1 and the test pit logs are presented in Appendix C. All test pits were backfilled and compacted with the excavated soil immediately after completion. The depth at which test pit digging was stopped was determined by the density of the material at the bottom of the pit, and test pits ended where digging generally became difficult.

2.4 IN-SITU TESTING

The test procedures used for soil permeability testing and water pressure testing in rock are described by the U.S. Bureau of Reclamation in the "Earth Manual," 2nd Edition, 1974.

2.4.1 Falling Head Tests

Falling head permeability tests were conducted in selected cased borings at various depths to determine the permeability of the soil. The tests were conducted by raising the water level in the casing above the static groundwater table and observing the fall of the water surface in the casing as a function of time. The tests were performed in one of two

ways: with soil cleaned out flush with the bottom of the casing; or after a split spoon sample was taken. The tests were continued until no drop in water level was observed or for at least 30 minutes. A summary of the falling head tests performed is presented in Table 2-3. Data for the falling head tests are presented in Appendix G.

2.4.2 Packer Tests

Water pressure testing of bedrock using packers was performed on 11 borings after coring rock to the required final depth. The testing was generally performed using an inflatable double packer assembly, with 2.2-foot long packer bladders. The packer tests were generally performed with a 10-foot test interval in ascending stages from the bottom of the borehole. A single packer was used for the first interval (the bottom of the borehole) and for each consecutive interval until the bedrock would take a measurable quantity of water. Double packers were then used in subsequent intervals moving upwards. Packer tests were performed in boreholes distributed throughout the site so that a range of permeability values could be determined.

A summary of the packer tests performed is presented in Table 2-4. The packer test data are presented in Appendix H.

2.4.3 Slug Tests

Slug tests were performed in monitoring well MG-B51-99 in order to measure the hydraulic conductivity of the fine grained soils encountered. Slug tests are designed to measure an aquifer's response to an instantaneous change in the static water level. These tests were performed using the method described in "A Slug Test for Determining the Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells," by Bouwer, Herman and Rice, R.C. 1976, Water Resources Research, Vol. 12, No. 3, pp 423-428 and the Hvorslev method as described in "Time Lag and Soil

TABLE 2-3

FALLING HEAD TESTS

Borehole No.	Test Depth (FT)	Elevation (FT)	
		From	To
MG-B2-99*	9 - 11	185.63	183.63
MG-B5-99*	9 - 11	190.49	188.49
MG-B30-99**	20 - 20	173.87	173.87
MG-B30-99**	30 - 30	163.87	163.87
MG-B32-99**	8 - 8	172.87	172.87
MG-B32-99*	12 - 14	168.87	166.87
MG-B36-99**	9.33 - 9.33	173.10	173.10
MG-B36-99**	10.5 - 10.5	171.93	171.93
MG-B51-99*	1 - 3	165.78	163.78
MG-B51-99*	4 - 6	162.78	160.78
MG-B51-99*	7 - 9	159.78	157.78
MG-B51-99*	10 - 12	156.78	154.78
MG-B51-99*	13 - 15	153.78	151.78
MG-B51-99*	16 - 16.25	150.78	150.53

Notes: All elevations presented refer to the mean sea level at Sandy Hook, NJ, as established by the US Coast and Geodetic Survey

* Test done after split spoon sampling

** Test done before sampling (cased hole - soil flush with bottom)

TABLE 2-4

PACKER TESTS

Borehole No.	Test Depth (FT)	Elevation (FT) From	To
MG-B2-99	140 - 150	54.63	44.63
MG-B2-99	130 - 140	64.63	54.63
MG-B2-99	120 - 130	74.63	64.63
MG-B2-99	110 - 120	84.63	74.63
MG-B2-99	70 - 80	124.63	114.63
MG-B2-99	60 - 70	134.63	124.63
MG-B2-99	50 - 60	144.63	134.63
MG-B2-99	40 - 50	154.63	144.63
MG-B2-99	30 - 40	164.63	154.63
MG-B2-99	20 - 30	174.63	164.63
MG-B5-99	65 - 75	134.49	124.49
MG-B5-99	55 - 65	144.49	134.49
MG-B5-99	45 - 55	154.49	144.49
MG-B5-99	35 - 45	164.49	154.49
MG-B5-99	25 - 35	174.49	164.49
MG-B5-99	15 - 25	184.49	174.49
MG-B17-99	65 - 74	127.33	118.33
MG-B17-99	55 - 65	137.33	127.33
MG-B17-99	45 - 55	147.33	137.33
MG-B17-99	35 - 45	157.33	147.33
MG-B17-99	25 - 35	167.33	157.33
MG-B17-99	15 - 25	177.33	167.33
MG-B17-99	5 - 15	187.33	177.33
MG-B18-99	70 - 80	124.72	114.72
MG-B18-99	60 - 70	134.72	124.72
MG-B18-99	50 - 60	144.72	134.72
MG-B18-99	40 - 50	154.72	144.72
MG-B18-99	30 - 40	164.72	154.72
MG-B18-99	20 - 30	174.72	164.72
MG-B23-99	74 - 80	118.34	112.34
MG-B23-99	64 - 74	128.34	118.34
MG-B23-99	54 - 64	138.34	128.34
MG-B23-99	44 - 54	148.34	138.34
MG-B23-99	34 - 44	158.34	148.34
MG-B23-99	24 - 34	168.34	158.34
MG-B23-99	14 - 24	178.34	168.34

Borehole No.	Test Depth (FT)	Elevation (FT) From	To
MG-B29-99	55 - 65	126.72	116.72
MG-B29-99	45 - 55	136.72	126.72
MG-B29-99	35 - 45	146.72	136.72
MG-B29-99	25 - 35	156.72	146.72
MG-B29-99	15 - 25	166.72	156.72
MG-B30-99	70 - 75	123.87	118.87
MG-B30-99	60 - 70	133.87	123.87
MG-B30-99	50 - 60	143.87	133.87
MG-B30-99	40 - 50	153.87	143.87
MG-B30-99	30 - 40	163.87	153.87
MG-B36-99	50 - 61	132.43	121.43
MG-B36-99	40 - 50	142.43	132.43
MG-B36-99	30 - 40	152.43	142.43
MG-B36-99	20 - 30	162.43	152.43
MG-B42-99	50 - 60	124.93	114.93
MG-B42-99	40 - 50	134.93	124.93
MG-B42-99	30 - 40	144.93	134.93
MG-B42-99	20 - 30	154.93	144.93
MG-B42-99	15 - 20	159.93	154.93
MG-B45-99	45 - 55	131.79	121.79
MG-B45-99	35 - 45	141.79	131.79
MG-B45-99	25 - 35	151.79	141.79
MG-B45-99	15 - 25	161.79	151.79
MG-B50-99	70 - 80	123.62	113.62
MG-B50-99	60 - 70	133.62	123.62
MG-B50-99	50 - 60	143.62	133.62
MG-B50-99	40 - 50	153.62	143.62
MG-B50-99	30 - 40	163.62	153.62
MG-B50-99	20 - 30	173.62	163.62

Note: All elevations presented refer to the mean sea level at Sandy Hook, NJ, as established by the US Coast and Geodetic Survey

Permeability in Groundwater Observations," U.S. Army Corps of Engineers, Vicksburg MS, April 1951.

Water level changes versus time were recorded in the field during the test. After establishing the static water level in the well, a 2-inch diameter, 5-foot PVC "slug" was gently introduced into the well and the water level was then allowed to stabilize (falling head test). Upon recovering the initial water level, the slug was quickly removed and a rising head test performed by recording water level measurements until the recovery of the initial water level was once again achieved. The volume of the slug is approximately 0.45 gallons.

After the slug was removed from the well, the water level change was recorded over time. A total of three falling and rising slug tests were conducted on monitoring well MG-B51-99. A summary of the slug test data and related graphs are presented in Appendix I.

2.5 MATERIALS TESTING

2.5.1 Soil Tests

Laboratory soils testing was performed on 31 split spoon and test pit samples mainly for grain size and moisture content determination. The tests were performed in accordance with the ASTM Standards listed below:

D-422	Method for Particle-Size Analysis of Soils.
D-854	Test Method for Specific Gravity
D-2216	Test Method for Moisture Content
D-4318	Atterberg Limits

The tests were performed by Long Island Materials Testing Laboratories, Inc., College Point, New York, in order to verify the field classification of the soils and evaluate the

various soil parameters. The soil tests performed are summarized in Table 2-5, Soil Testing Summary, and the laboratory test results are presented in Appendix J.

2.5.2 Rock Tests

Laboratory rock testing was performed on selected rock core samples recovered from various borings. The rock tests were performed by Long Island Materials Testing Laboratories, Inc. The testing included unconfined compressive strength, tensile strength, and instrumented unconfined compressive strength with strain measurements. The tests were performed in accordance with the ASTM Standards listed below:

D-2938	Standard Test Method for Unconfined Compressive Strength of Intact Rock Core Specimens
D-2936	Standard Test Method for Direct Tensile Strength of Intact Rock Core Specimens
D-3148	Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

A summary of the rock tests is presented in Table 2-6, Rock Tests, and the laboratory test results are presented in Appendix J. It should be noted that since the laboratory tests are performed on small specimens, the results are not fully representative of a large rock mass condition, that could be significantly influenced by the discontinuities.

2.6 GROUNDWATER QUALITY ANALYSIS

Groundwater samples from selected piezometers were collected for laboratory analysis to determine groundwater quality for dewatering during construction. The groundwater level was measured for each piezometer to calculate the volume of water it held. The slow recharge of the piezometers precluded the evacuation of the standard three piezometer volumes for groundwater sampling. Consequently, only one volume of groundwater that the piezometer held was evacuated prior to retaining the sample. The

TABLE 2-5

SOIL TESTS

SPLIT SPOON SAMPLES

Borehole No.	Sample Depth (FT)		Sample Elevation (FT)		Sample No.	UCS Symbols	NYC Building Code Class	Mechanical Analysis ASTM D-422	Moisture Content ASTM D-2216	Specfic Gravity ASTM D-854
	From	To	From	To						
MG-B1-99	8.0	10.0	180.36	178.36	SS-5	SM	6-65	Yes	9.5	
MG-B6-99	6.0	8.0	189.84	187.84	SS-4	SM/GM	6-65	Yes	2.1	
MG-B10-99	4.0	6.0	189.13	187.13	SS-3	SM/GM	6-65	Yes		
MG-B22-99	10.0	10.4	183.22	182.82	SS-6	SM/GM	6-65	Yes		
MG-B22-99	20.0	22.0	173.22	171.22	SS-8	SM/GM	6-65/5-65	Yes		
MG-B25-99	4.0	6.0	177.35	175.35	SS-3	SM,SP-SM	6-65	Yes	12.2	
MG-B26-99	6.0	8.0	185.48	183.48	SS-4	SM/GM	6-65	Yes		
MG-B26-99	33.5	34.2	157.98	157.28	SS-8	SM/GM	6-65	Yes	27.6	2.72
MG-B27-99	14.0	16.0	178.16	176.16	SS-6	SM/GM	6-65/5-65	Yes		
MG-B27-99	22.0	24.0	170.16	168.16	SS-10	SP-SM/GP-GM	6-65/5-65	Yes		
MG-B28-99	8.0	10.0	180.28	178.28	SS-5	SM,SP-GM	6-65	Yes		
MG-B30-99	6.0	8.0	187.87	185.87	SS-4	SM,SP-GM	6-65	Yes	7.3	
MG-B30-99	16.3	18.3	177.57	175.57	SS-6	SM/GM	6-65/5-65	Yes		
MG-B31-99	8.0	10.0	180.34	178.34	SS-5	SP-SM/GP-GM	6-65	Yes	8.7	
MG-B33-99	7.0	9.0	166.13	164.13	SS-4	SM/GM	6-65	Yes		
MG-B35-99	6.0	8.0	172.24	175.24	SS-4	SM,SP-SM	7-65	Yes		
MG-B35-99	10.0	12.0	173.24	171.24	SS-6	SM/GM	6-65/5-65	Yes		
MG-B36-99	10.0	12.0	172.43	170.43	SS-6	SM	7-65	Yes		
MG-B39-99	14.0	16.0	165.20	163.20	SS-8	SM/GM	6-65/5-65	Yes	10	2.67
MG-B43-99	6.0	8.0	168.84	166.84	SS-4	SP-SM/GP-GM	6-65	Yes		
MG-B43-99	10.0	12.0	164.84	162.84	SS-6	SM/GM	6-65/5-65	Yes		
MG-B47-99	6.0	8.0	166.97	164.97	SS-4	SP-SM/GP-GM	6-65	Yes	8.4	
MG-B48-99	10.0	12.0	169.30	167.30	SS-6	SM	6-65	Yes	37.3	
MG-B48-99	21.0	23.0	158.30	156.30	SS-10	SM/GM	6-65	Yes	10.8	2.72
MG-B49-99	8.0	10.0	186.48	184.48	SS-5	SM/GP	6-65	Yes		
MG-B49-99	20.0	22.0	174.48	172.48	SS-7	SM/GM	6-65	Yes	10	2.71

TEST PIT SAMPLES

Test Pit No.	Sample Depth (FT)		Sample Elevation (FT MSL)		Sample No.	UCS Symbols	NYC Building Code Class	Mechanical Analysis ASTM D-422	Atterberg Limits (%) ASTM D-4318		Specfic Gravity ASTM D-854
	From	To	From	To					Liquid Limit	Plastic Limit	
MG-TP1-99	7.5	7.5	173.86	173.86	TP-1	SM/GM	6-65/5-65	Yes			
MG-TP4-99	10.0	10.0	187.02	187.02	TP-4	SM/GM	6-65	Yes			
MG-TP6-99	10.0	10.0	185.32	185.32	TP-6	SM	6-65	Yes			
MG-TP7-99	9.0	9.0	183.28	183.28	TP-7	SM	6-65	Yes			
MG-TP10-99	7.5	7.5	161.10	161.10	TP-10	SM	7-65	Yes*	32	17	2.62

* With Hydrometer Analysis

Note: All elevations presented refer to the mean sea level at Sandy Hook, NJ, as established by the US Coast and Geodetic Survey

TABLE 2-6

ROCK TESTS

Borehole No.	Sample Depth (FT)		Sample Elevation (FT MSL)		Rock Description	NYC Building Code Class	Unconfined Compressive Strength (PSI)	Tensile Strength (PSI)	Unconfined Compressive Strength with Strain Measurements	
									Young's Modulus (KSI)	Poisson's Ratio
	From	To	From	To			ASTM D-2938	ASTM D-2936	ASTM D-3148 A	ASTM D-3148 B
MG-B1-99	44.0	44.7	144.36	143.66	Quartz Banded Gneiss	1-65		720		
MG-B1-99	49.5	50.0	138.86	138.36	Quartz Banded Gneiss	1-65	2,605			
MG-B1-99	74.2	75.0	114.16	113.36	Quartz Banded Gneiss	3-65	9,646			
MG-B2-99	49.0	50.0	145.63	144.63	Quartz Banded Gneiss	2-65/3-65	15,399			
MG-B2-99	55.8	56.5	138.83	138.13	Quartz Banded Gneiss	1-65		770		
MG-B2-99	81.0	81.5	113.63	113.13	Quartz Banded Gneiss	1-65	16,232			
MG-B2-99	119.0	120.0	75.63	74.63	Quartz Banded Gneiss	1-65		900		
MG-B3-99	34.7	35.3	162.33	161.73	Gneiss	3-65	5,209			
MG-B3-99	52.8	53.5	144.23	143.53	Gneiss	1-65		830		
MG-B5-99	50.8	51.5	148.69	147.99	Amphibolitic Gneiss	1-65	7,400		306	0.28
MG-B6-99	19.1	19.6	176.74	176.24	Amphibolitic Gneiss	3-65/2/65		760		
MG-B6-99	38.0	38.7	157.84	157.14	Gneiss	2-65	20,257			
MG-B7-99	35.0	35.5	158.46	157.96	Gneiss	1-65		840		
MG-B7-99	58.0	58.5	135.46	134.96	Quartz Banded Gneiss	1-65		960		
MG-B7-99	82.8	83.4	110.66	110.06	Quartz Banded Gneiss	1-65	19,678			
MG-B8-99	81.0	82.0	114.92	113.92	Quartz Banded Gneiss	1-65	8,910		897	0.34
MG-B9-99	71.5	72.0	126.63	126.13	Gneiss	1-65	9,486			
MG-B10-99	26.0	26.8	167.13	166.33	Quartz Banded Gneiss	1-65	13,726			
MG-B10-99	53.5	54.0	139.63	139.13	Gneiss	1-65	5,573			
MG-B12-99	79.5	80.3	115.69	114.89	Quartz Banded Gneiss	1-65	13,666			
MG-B13-99	66.9	67.5	129.07	128.47	Quartz Banded Gneiss	1-65	16,881			
MG-B13-99	67.5	68.0	128.47	127.97	Quartz Banded Gneiss	1-65		610		
MG-B15-99	24.5	25.0	171.06	170.56	Gneiss	1-65		780		
MG-B15-99	37.7	38.4	157.86	157.16	Gneiss	1-65	7,630			
MG-B15-99	44.0	44.6	151.56	150.96	Gneiss	1-65		820		
MG-B15-99	70.5	71.0	125.06	124.56	Quartz Banded Gneiss	1-65	13,183			
MG-B16-99	31.8	32.4	163.07	162.47	Gneiss	1-65		620		
MG-B16-99	64.5	65.0	130.37	129.87	Gneiss	1-65	9,108			
MG-B17-99	22.5	23.3	169.83	169.03	Gneiss	1-65		790		
MG-B17-99	47.4	48.2	144.93	144.13	Gneiss	1-65	7,515		414	0.14
MG-B18-99	32.0	32.5	162.72	162.22	Gneiss	1-65	7,825			
MG-B18-99	52.1	52.8	142.62	141.92	Gneiss	1-65	3,864			
MG-B19-99	68.9	69.4	126.67	126.17	Quartz Banded Gneiss	1-65	18,810		479	0.04
MG-B20-99	63.5	64.3	127.44	126.64	Quartz Banded Gneiss	1-65	9,580		300	0.34
MG-B21-99	24.8	25.3	165.73	165.23	Gneiss	2-65	9,459			
MG-B21-99	35.0	35.8	155.53	154.73	Gneiss	2-65	3,599			
MG-B21-99	62.0	63.0	128.53	127.53	Quartz Banded Gneiss	1-65	10,255			
MG-B22-99	48.0	48.7	145.22	144.52	Gneiss	1-65		530		
MG-B22-99	73.0	73.6	120.22	119.62	Gneiss	1-65	9,968			
MG-B23-99	66.5	67.5	125.84	124.84	Quartz Banded Gneiss	2-65	11,897			
MG-B23-99	67.8	68.5	124.54	123.84	Quartz Banded Gneiss	2-65		420		
MG-B24-99	22.0	22.5	163.74	163.24	Gneiss	3-65/2-65		980		
MG-B24-99	46.0	46.5	139.74	139.24	Quartz Banded Gneiss	1-65		1,030		
MG-B24-99	56.0	57.0	129.74	128.74	Gneiss	1-65	4,502			
MG-B26-99	57.8	58.6	133.68	132.88	Gneiss	1-65	5,850		418	0.26
MG-B27-99	69.3	69.8	122.86	122.36	Gneiss	1-65	7,331			
MG-B28-99	61.8	62.3	126.48	125.98	Quartz Banded Gneiss	1-65/2-65	12,219			
MG-B29-99	52.1	52.8	129.62	128.92	Gneiss	2-65	6,470		600	0.24
MG-B30-99	63.0	63.7	130.87	130.17	Quartz Banded Gneiss	1-65	13,762			
MG-B30-99	63.7	64.5	130.17	129.37	Quartz Banded Gneiss	1-65		900		
MG-B31-99	60.5	61.4	127.84	126.94	Quartz Banded Gneiss	1-65	13,855		880	0.24
MG-B32-99	29.0	30.0	151.87	150.87	Gneiss	1-65	9,421			
MG-B35-99	55.4	56.1	127.84	127.14	Quartz Banded Gneiss	1-65	13,505			
MG-B35-99	56.1	57.0	127.14	126.24	Quartz Banded Gneiss	1-65		1,020		
MG-B36-99	55.3	56.0	127.13	126.43	Amphibolitic Gneiss	1-65	8,457			
MG-B39-99	24.5	25.0	154.70	154.20	Quartz Banded Gneiss	2-65		710		
MG-B39-99	56.1	56.6	123.10	122.60	Gneiss	2-65	8,080		418	0.24
MG-B40-99	51.8	52.3	125.97	125.47	Gneiss	1-65	9,970		471	0.10
MG-B41-99	15.7	16.2	161.55	161.05	Gneiss	1-65	9,740			
MG-B42-99	27.5	27.9	147.43	147.03	Gneiss	3-65	4,618			
MG-B42-99	49.0	49.8	125.93	125.13	Gneiss	1-65	3,564			
MG-B43-99	23.8	24.6	151.04	150.24	Gneiss	2-65		320		
MG-B43-99	46.1	46.7	128.74	128.14	Gneiss	1-65	6,945			
MG-B45-99	39.8	40.3	136.99	136.49	Gneiss	2-65/1-65	7,560		379	0.31
MG-B46-99	48.0	48.8	127.44	126.64	Gneiss	1-65	9,357			
MG-B46-99	49.0	50.0	126.44	125.44	Gneiss	1-65		670		
MG-B49-99	63.8	64.3	130.68	130.18	Gneiss	3-65	10,096			
MG-B50-99	25.3	26.0	168.32	167.62	Quartz Banded Gneiss	1-65/2-65	10,064			
MG-B50-99	44.2	44.7	149.42	148.92	Quartz Banded Gneiss	1-65/2-65	7,866			

Note: All elevations presented refer to the mean sea level at Sandy Hook, NJ, as established by the US Coast and Geodetic Survey

groundwater samples were submitted to Accutest Laboratories, Dayton, New Jersey for analysis. The analysis performed and the results are presented in Appendix K.

SECTION 3
CONCLUSIONS

The subsurface exploration program was conducted at the Mosholu Golf Course to obtain information on:

- The depth and quality of bedrock in the area of the proposed water treatment plant;
- The nature and extent of the overburden materials encountered;
- The permeability of the overburden soil and rock mass;
- The groundwater conditions and gradient;
- The characteristics of the rock mass, i.e., strength, orientation of foliation, joints and fracture system, weathering;
- Orientation of foliation and joints in the rock mass.

The majority of material recovered was rock belonging to the Fordham Gneiss Formation, generally a light-to-medium gray-banded muscovite-biotite-plagioclase-quartz-gneiss. The bedrock is relatively close to the ground surface, 4 to 40 feet.

The laboratory rock testing indicates a variability in the strength and permeability of the rock mass. The joint spacing is also variable, from close (2 to 12 inches) to wide (greater than 3 feet). However, most RQD's are greater than 80 percent, indicating a good quality rock.

The majority of the overlying soil is till or soil-like decomposed rock (saprolite). Imported fill or reworked till may overlay the till or saprolite. The till and saprolite are compact to very compact, and contain boulders and rock fragments.

SECTION 4
LIMITATIONS

4.1 SUBSURFACE INFORMATION

4.1.1 Interface of Strata

The stratification lines shown on the individual boring logs of the Geotechnical Data Report represent the approximate boundaries between soil and rock types and the transitions may be gradual.

4.1.2 Boring Logs

The boring logs contain factual information on the soil conditions represented by the soil samples and on rock cores recovered for each borehole performed.

4.1.3 Water Levels

Water level readings have been made in the exploration on the dates and conditions stated on the individual logs. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors.

4.1.4 Pollution/Contamination

Unless specifically indicated to the contrary in this Report, the scope of the Joint Venture's services was limited only to investigation and evaluation of the geotechnical engineering aspects of the site conditions, and did not include any consideration of potential site pollution or contamination resulting from the presence of chemicals, metals, radioactive elements, etc. This Report offers no facts or opinions related to potential pollution/contamination of the site.

4.1.5 Environmental Considerations

Unless specifically indicated to the contrary, this Report does not address environmental considerations, which may affect the site development, e.g., wetlands determinations, flora and fauna, wildlife, etc. The conclusions and recommendations of this Report are not intended to supersede any environmental conditions. Environmental considerations are described in the Final Environmental Impact Statement for the Croton Water Treatment Plant (NYCDEP, May 1999).

4.2 APPLICABILITY OF REPORT

This Report has been prepared in accordance with generally accepted geotechnical engineering practices for the exclusive use of Metcalf & Eddy/Hazen and Sawyer, A Joint Venture for specific application to the design of the proposed improvements. No other warranty, expressed or implied, is made.

This Report may be referred to in the project specifications for general information purposes only, but should not be used as the technical specifications for the work, as it was prepared for design purposes exclusively.

4.3 REINTERPRETATION OF RECOMMENDATIONS

4.3.1 Changes in Location or Nature of Facilities

In the event that any changes in the nature and design or location of the facilities are planned, the conclusions and recommendations contained in this Report shall not be considered valid unless the changes are reviewed and conclusions of this Report modified or verified in writing.

4.4 USE OF REPORT BY PROSPECTIVE BIDDERS

This Geotechnical Data Report was prepared for the project by Metcalf & Eddy/Hazen and Sawyer, A Joint Venture, and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the Report should do so with the express understanding that its scope is limited to design considerations.

THIS PAGE INTENTIONALLY LEFT BLANK

Geotechnical Data Report

on

Subsurface Exploration for

The Croton Water Treatment Plant

at Mosholu Golf Course, Van Cortlandt Park

Borough of the Bronx, City of New York

Volume 2
Appendices

City of New York
Department of Environmental Protection
Bureau of Environmental Engineering

November 2000

Metcalf & Eddy of New York, Inc. - HAZEN AND SAWYER, P.C.

A Joint Venture

TABLE OF CONTENTS

APPENDIX A - Test Boring Logs

APPENDIX B - Air Track Boring Data

APPENDIX C -Test Pit Logs

APPENDIX D - Oriented Core Measurements

APPENDIX E - Piezometer and Monitoring Well Logs

APPENDIX F - Piezometer and Monitoring Well Readings

APPENDIX G - Falling Head Test Data

APPENDIX H - Packer Test Data

APPENDIX I - Slug Test Data

APPENDIX J - Laboratory Soil and Rock Test Results

APPENDIX K Groundwater Quality Analysis

APPENDIX A

TEST BORING LOGS

THIS PAGE INTENTIONALLY LEFT BLANK

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B1-99
LINE & STA. N:322,939.04
OFFSET E:624,346.55

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-16-99
DATE. FINISH: 2-17-99

GROUND ELEVATION 188.36
GROUND WATER ELEVATION 179.06 2/22/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	16"	1	1	1	1		0'-	TOPSOIL 4". DARK BROWN SILT WITH SAND, ORGANIC
		SS2	2'-4'	14"	2	4	12	12		4'	MATTER IN TOP 2 FEET. VERY SOFT TO STIFF. (ML) (11-65)
		SS3	4'-6'	16"	21	24	35	28			
		SS4	6'-8'	10"	38	19	24	28			RUSTY BROWN SILTY FINE SAND TRACE TO
10		SS5	8'-10'	15"	31	38	41	43		10'	SOME GRAVEL, VERY DENSE. (SM) (6-65)
		SS6	10'-10.7'	4"	43	100	/2"			13'	YELLOW BROWN SILTY SAND WITH MICA, ROCK FRAGMENTS (GNEISS), COBBLES. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
20											
		R1	13'-23'	94% REC 91% RQD							GNEISS. MEDIUM GRAY, SLIGHTLY WEATHERED TO UNWEATHERED. SOME OXIDATION ON JOINTS TO 46'. FOLIATION AT 40 DEGREES TO SUB-VERTICAL. QUARTZITIC FROM 71' TO 74', 76' TO 79', 92.5' TO 95'. FROM 13' TO 28', 40-DEGREE FOLIATION JOINTS PREDOMINATE. CLOSE TO MODERATELY CLOSE JOINT SPACING.
30		R2	23'-33'	97% REC 76% RQD							
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B1-99
LINE & STA N:322,939.04
OFFSET E:624,346.55

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-16-99
DATE. FINISH: 2-17-99

GROUND ELEVATION 188.36
GROUND WATER ELEVATION 179.06 2/22/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R3	33'-43'	97% REC 88% RQD							ROCK IS GENERALLY GOOD. (1-65) FROM 28' TO 40', CLOSE JOINT SPACING FROM 29.5' TO 31.5', SUBVERTICAL FOLIATION JOINT, SMOOTH, TIGHT, MICA. FROM 38.5' TO 39.2', A 70-DEGREE JOINT WITH FOLIATION TREND, OXIDIZED, ROUGH. AT 40.2' AND 42.3', TWO 60-DEGREE JOINTS WITH FOLIATION TREND, OXIDIZED, CHLORITIC ALTERATION, ROUGH. (2-65) FROM 40' TO 69', MODERATELY CLOSE JOINT SPACING. AT 46.2', A 60-DEGREE JOINT WITH FOLIATION TREND, CHLORITIC ALTERATION, ROUGH. AT 51', A 60-DEGREE JOINT WITH FOLIATION TREND, ALTERATION IN EPIDOTE, ROUGH. FROM 61.75' TO 62' A 70-DEGREE FOLIATION JOINT, SMOOTH, TALC. FROM 40' TO 69', ROCK IS
50											
10		R4	43'-53'	98% REC 86% RQD							
		R5	53'-55'	100 % REC 100 % RQD							
60											
20											
		R6	55'-65'	100 % REC 93% RQD							
70											
30											
		R7	65'-75'	100 % REC 74% RQD							
80											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 4
LOCATION BRONX, NY
HOLE NO MG-B1-99
LINE & STA N:322,939.04
OFFSET E:624,346.55

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START: 2-16-99
DATE. FINISH 2-17-99

GROUND ELEVATION 188.36
GROUND WATER ELEVATION 179.06 2/22/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											GENERALLY VERY GOOD. (1-65)
80											
		R8	75'-85'	98% REC							FROM 69' TO 82.5', ROCK IS CLOSELY JOINTED. FROM 69.5' TO 70.3', A SMOOTH FOLIATION JOINT AT 80 DEGREES. FROM 71' TO 82.7', VERY CLOSELY TO CLOSELY JOINTED. FROM 73.7' TO 74.2', A 70-DEGREE FOLIATION JOINT, SMOOTH, MICA. FROM 76.5' TO 77.5', AN 85-DEGREE FOLIATION JOINT, SMOOTH, SLIGHTLY ALTERED IN CHLORITE, OPEN, WITH 30-DEGREE JOINTS WITH FOLIATION TREND, SOFT. FROM 79.2' TO 79.5', A 70-DEGREE SMOOTH FOLIATION JOINT, EPIDOTE, MICA, OPEN.
				52% RQD							
90											
10											
		R9	85'-95'	100 % REC						95'	
				92% RQD							
100											
20											
110											
30											
120											FROM 80' TO 82.5', TWO 80-DEGREE FOLIATION JOINTS, SMOOTH, SOFT, OPEN, CHLORITIC ALTERATION, WITH FOUR 30-DEGREE JOINTS WITH FOLIATION TREND. (3-65)
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 4 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B1-99
LINE & STA. N:322,939.04
OFFSET E:624,346.55

DEPTH _____ FT. ____ FT CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-16-99
DATE. FINISH: 2-17-99

GROUND ELEVATION 188.36
GROUND WATER ELEVATION 179.06 2/22/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											BELOW 82.5', MODERATELY CLOSE TO WIDE JOINT SPACING. FROM 85' TO 85.4', AN 80-DEGREE FOLIATION JOINT, SMOOTH, MICA, OPEN. AT 92.5', A 60-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT. (1-65)
10											
20											END OF HOLE 95'
30											
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 4
LOCATION BRONX, NY
HOLE NO MG-B2-99
LINE & STA N:323,039.00
OFFSET E:624,359.03

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START 3-4-99
DATE. FINISH 3-10-99

GROUND ELEVATION 194.63
GROUND WATER ELEVATION 186.35 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING ____ SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	18"	1	1	1	2		0'-	FROM 0' TO 2', DARK BROWN SANDY SILT, ORGANIC MATTER,
	SS2	2'-4'	15"	3	5	4	5		4'	SOFT. RUST BROWN, SANDY SILT, STIFF, FROM 2' TO 4' (ML) (11-65)
	SS3	8'-10'	9"	16	31	40	42		11'	RUSTY BROWN SILTY SAND WITH SANDY SILT INTERLAYERS, ROCK FRAGMENTS. (SM) (6-65)
	R1	11'-15'	95% REC 85% RQD							GNEISS. MEDIUM GRAY, PYRITIC THROUGHOUT, MODERATELY HARD TO HARD, SCHISTOSE TO 37.5', QUARTZITIC BELOW 95'. WEATHERED AND OXIDIZED TO 36.5'. FOLIATION VARIES FROM 40 TO 80 DEGREES. CLOSE TO MODERATELY CLOSE SPACING.
	R2	15'-24'	98% REC 65% RQD							FRACTURED AND OXIDIZED FROM 17' TO 18', 23' TO 24'. SOFT TO MODERATELY HARD FROM 32.7' TO 34.6' WITH SMOOTH FOLIATION JOINTS, OXIDIZED, WEATHERED ZONE. STRONGLY OXIDIZED ON SMOOTH FOLIATION JOINTS, SOFT, FRIABLE, FROM
	R3	24'-34'	100% REC 86% RQD							

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 4
LOCATION BRONX, NY
HOLE NO MG-B2-99
LINE & STA N:323,039.00
OFFSET E:624,359.03

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START 3-4-99
DATE. FINISH 3-10-99

GROUND ELEVATION 194.63
GROUND WATER ELEVATION 186.35 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING ____ SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											35.5' TO 36.5'.
40											
		R4	34'-44'	100 %	REC						FROM 40' TO 44', NINE 10 DEGREE-JOINTS ACROSS FOLIATION, ROUGH, WITH TWO 50-DEGREE FOLIATION JOINTS. (2-65/3-65) ROCK CLASS FROM 11' TO 24', 32.7' TO 54'; (2-65) CLASS FROM 24' TO 32.7'. FRACTURED FROM 48' TO 49', 53' TO 54'. ROCK QUALITY IM-PROVES FROM 54' TO 133' WITH MODERATE-LY CLOSE TO WIDE JOINT SPACING(1-65)
				55%	RQD						
50											
10											
		R5	44'-54'	90%	REC						
				58%	RQD						
60											
20											
		R6	54'-64'	97%	REC						FROM 90.45'TO 91.1' A SMOOTH 10-DEGREE JOINT ACROSS FOLIATION. AT 133.25', A SMOOTH 10-DEGREE JOINT ACROSS FOLIATION. FROM 135' TO 136.8' A SUBVERTICAL FOLIATION JOINT, SMOOTH, OPEN, ALTERATION IN CHLORITE, WITH FOUR 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OPEN.
				97%	RQD						
70											
30											
		R7	64'-74'	100 %	REC						
				100 %	RQD						
80											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B2-99
LINE & STA. N:323,039.00
OFFSET E:624,359.03

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START: 3-4-99
DATE. FINISH. 3-10-99

GROUND ELEVATION 194.63
GROUND WATER ELEVATION 186.35 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING ____ SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											AT 142' AND 146.3', TWO 40-DEGREE SMOOTH JOINTS ACROSS FOLIATION, ALTERATION IN CHLORITE, EPIDOTE.
		R8	74'-84'	100 % REC 97% RQD							
90											FROM 146.8' TO 147.2', THREE 30-DEGREE JOINTS WITH FOLIATION TREND, ROUGH, WITH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH. (2-65) CLASS FROM 133' TO 140'. (1-65) CLASS BELOW 140'.
10											
		R9	84'-94'	100 % REC 95% RQD							
100											
20											
		R10	94'-104'	93% REC 88% RQD							
110											
30		R11	104'-110'	100 % REC							
120		R12	110'-120'	98% REC 93% RQD							
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 4 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B2-99
LINE & STA. N:323,039.00
OFFSET E:624,359.03

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE, START: 3-4-99
DATE, FINISH: 3-10-99

GROUND ELEVATION 194.63
GROUND WATER ELEVATION 186.35 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING ____ SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
120											
130		R13	120'-130'	95% REC 82% RQD							
10											
140		R14	130'-140'	95% REC 55% RQD							
20											
150		R15	140'-150'	98% REC 94% RQD						150'	END OF HOLE 150' ORIENTED CORE FROM 110' TO 150'. PERMEABILITY TESTS IN SOIL. WATER PRESSURE TESTS IN ROCK FROM 30' TO 150'. TWO PIEZOMETERS INSTALLED AT 84' AND 149'.
30											
160											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B3-99
LINE & STA. N:323,138.09
OFFSET E: 624,368.95

DEPTH _____ FT. ____ FT. CASING OUT DATE. _____
DEPTH _____ FT. ALL CASING OUT DATE _____

DATE. START: 2-19-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 197.03
GROUND WATER ELEVATION 184.40 2/26/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	18"	1	1	1	2		0'-	TOPSOIL (3"). DARK GRAY SILT WITH FINE
									3'	SAND, ORGANIC MATTER. SOFT. (ML) (11-65)
	SS2	2'-4'	6"	3	3	8	20			
	SS3	4'-6'	14"	22	27	31	38			
	SS4	6'-7.2'	12"	31	44	100	/3"			YELLOW BROWN SILTY FINE SAND, TRACE TO SOME GRAVEL, ROCK FRAGMENTS, COBBLES.
	SS5	8'-8.4'	3"	100	/5"				11'	DENSE TO VERY DENSE (SM) (6-65)
	R1	11'-15'	63% REC 25% RQD							GNEISS. MEDIUM GRAY. SLIGHTLY WEATHERED TO UN-WEATHERED. SCHISTOSE(BIOTITE GNEISS) FROM 35.5' TO 40.5', 65'TO 66' 105' TO 112.5', 143' TO 150'. AMPHIBOLITIC FROM 112.5' TO 140'. FOLIATION AT 50 DEGREES TO SUB-VERTICAL. FRACTURED TO 23', ALTERATION IN EPIDOTE AND OXIDATION ON JOINTS TO 16.5'.(4-65/ 3-65).
	R2	15'-23'	44% REC 43% RQD							
	R3	23'-27.5'	93% REC 65% RQD							FAIR, CLOSELY JOINTED ROCK FROM 23' TO 28.5'. SMOOTH JOINTS. TALC AND CARBONATE COAT-ING AT 23'. A 40-DEGREE JOINT ALONG FOLIATION WHICH IS
	R4	27.5'-33'	97% REC 76% RQD							

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B3-99
LINE & STA N:323,138.09
OFFSET E: 624,368.95

DEPTH _____ FT ____ FT CASING OUT DATE. _____
DEPTH _____ FT ALL CASING OUT DATE: _____

DATE. START. 2-19-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 197.03
GROUND WATER ELEVATION 184.40
2/26/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R5	33'-42.5'	100 % REC 75% RQD							STEEPER(50 DEGREES) FROM 32.5' TO 37.5' CLOSELY SPACED JOINTS, MAINLY FOLIATION JOINTS, ALTERATION IN CHLORITE, A FEW JOINTS WITH TALC. (3-65).
		R6	42.5'-45'	100 % REC 100 % RQD							
50											
10											FROM 37.5' TO 55' MODERATELY CLOSE TO WIDE JOINT SPACING. AT 42.5', A SMOOTH 50-DEGREE JOINT. A 70-DEGREE FOLIATION JOINT. FROM 51.7' TO 52.6' (1-65)
		R7	45'-55'	98% REC 83% RQD							
60											
20											FROM 54.5' TO 58.5', ROCK IS CLOSELY JOINTED. FROM 58.5' TO 65', MODERATELY CLOSE JOINTED SPACING. A 50-DE GREE JOINTS ACROSS FOLIATION, SMOOTH, OPEN, FROM 57' TOO 58'. (2-65)
		R8	55'-65'	99% REC 78% RQD							
70											
30											FROM 65' TO 76.7', ROCK IS CLOSELY JOINTED WITH SMOOTH JOINTS. FROM 65' TO 66.3', THREE SMOOTH FOLIATION JOINTS AT 75'. FROM 66.5' TO 67', A 60-DEGREE FOLIATION JOINT, SMOOTH, MICA.
		R9	65'-75'	96% REC 42% RQD							
80											
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 4
LOCATION BRONX, NY
HOLE NO MG-B3-99
LINE & STA N:323,138.09
OFFSET E: 624,368.95

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE, START: 2-19-99
DATE, FINISH: 2-24-99

GROUND ELEVATION 197.03
GROUND WATER ELEVATION 184.40 2/26/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
		R10	75'-85'	93% REC 73% RQD							
90											
10											
		R11	85'-95'	99% REC 98% RQD							
100											
20											
		R12	95'-105'	97% REC 91% RQD							
110											
30											
		R13	105'-113'	98% REC 87% RQD							
120											
40											

FROM 71' TO 73', THREE SMOOTH 60-DEGREE FOLIATION JOINTS, CHLORITE ALTERATION WITH THREE 20 TO 40-DEGREE JOINTS ACROSS FOLIATION. FROM 74.5' TO 75', A 75-DEGREE FOLIATION JOINT, SMOOTH, MICA. FROM 76' TO 76.7', SMOOTH FOLIATION JOINTS WITH TALC COATING. (3-65)

ROCK QUALITY IMPROVES AT 76.7' SUBHORIZONTAL JOINTS PREDOMINATE FROM 76.7' TO 133'. FROM 83' TO 84', A CURVED 75-DEGREE FOLIATION JOINT, SMOOTH. FROM 97.2' TO 99.5', A SUB-VERTICAL FOLIATION JOINTS, SMOOTH. FROM 140.7' TO 141.2', A 50-DEGREE FOLIATION JOINT, SMOOTH. AT 142.25' A 50-DEGREE FOLIATION JOINT, SMOOTH. IN GENERAL. GOOD ROCK. (1-65)

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 4 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B3-99
LINE & STA. N:323,138.09
OFFSET E: 624,368.95

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-19-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 197.03
GROUND WATER ELEVATION 184.40
2/26/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
120											
		R14	113'-123'	96% REC							
				93% RQD							
130											
10											
		R15	123'-133'	100 % REC							
				100 % RQD							
140											
20		R16	133'-140'	98% REC							
				93% RQD							
150											
30		R17	140'-150'	98% REC						150'	
				90% RQD							END OF HOLE 150'
160											
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B4-99
LINE & STA N:323,241.02
OFFSET E:624,352.78

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-25-99
DATE. FINISH: 2-26-99

GROUND ELEVATION 198.82
GROUND WATER ELEVATION ____

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300 LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	ANGLED BOREHOLE DIRECTION: N 82 DEGREES E ANGLE:60 DEGREES ROLLER BIT TO TOP OF ROCK NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL
10										15'	
20		R1	15'-25'	96% REC 48% RQD							GNEISS. MEDIUM GRAY. MODERATELY WEATHERED TO UN-WEATHERED, MODERATELY HARD. AMPHIBOLITIC FROM 50' TO 56', 97.5' TO 100';QUARTZITIC FROM 64' TO 66'; 100' TO 104.5'; SCHISTOSE (MICA) FROM 33' TO 34',40' TO 50'; 66' TO 68', 78.5' TO 80'. FOLIATION VARIES FROM 20 TO 40 DE-GREES TO 48' AND FROM 50 TO 70 DE-GREES ON REST OF CORE. OXIDATION ON JOINTS TO 28.5' AND FROM 66.1' TO 69' ON 60-DEGREE JOINTS ACROSS FOLIATION
30		R2	25'-35'	91% REC 54% RQD							
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B4-99
LINE & STA N:323,241.02
OFFSET E:624,352.78

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE, START: 2-25-99
DATE, FINISH: 2-26-99

GROUND ELEVATION 198.82
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300 LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											CLOSE JOINT SPACING FROM 17.5' TO 22', 33.5' TO 50', MAINLY FOLIATION JOINTS, SMOOTH. FROM 21.5' TO 22', A VERTICAL JOINT, SILT COATING. AT 38.5', A VERY SMOOTH JOINT, ALTERATION IN CHLORITE AND EPIDOTE, POSSIBLE SHEAR.
40		R3	35'-45'	96% REC 63% RQD							
50											
10											
		R4	45'-55'	96% REC 64% RQD							FROM 47' TO 51.25', SOFT, FRIABLE, CHLORITE ALTERATION, WITH FIVE FOLIATION JOINTS AT 70 DEGREES FROM 48.5' TO 50'. (3-65) BELOW 51.25', CLOSE TO MODERATELY CLOSE JOINT SPACING. QUARTZITIC ZONE FROM 66' TO 68' WITH THREE 60-DEGREE JOINTS, ROUGH, TIGHT, OXIDIZED. SMOOTH 30-DEGREE JOINTS AT 76.5', 79.7' TO 80', 97.5' TO 105'.
60											
20											
		R5	55'-65'	98% REC 96% RQD							
70											
30											
		R6	65'-75'	92% REC 81% RQD							
80											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B4-99
LINE & STA. N:323,241.02
OFFSET E:624,352.78

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE, START: 2-25-99
DATE, FINISH: 2-26-99

GROUND ELEVATION 198.82
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300 LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
		R7	75'-85'	98%	REC						AT 97.5', 98.5', FOLIATION JOINTS, SMOOTH, TIGHT, EPIDOTE, MICA. IRREGULAR, CURVED JOINT AT 100.25' TO 101.4' ALONG A QUARTZITE BAND, SMOOTH, TIGHT, CHLORITE. (1-65)
				93%	RQD						
90											
10											
		R8	85'-95'	98%	REC						
				93%	RQD						
100											
20											
		R9	95'-105'	100	% REC					105'	
				87%	RQD						END OF HOLE 105'
110											
30											
120											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B5-99
LINE & STA N:323,338.35
OFFSET E:624,394.20

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE START: 3-4-99
DATE FINISH: 3-8-99

GROUND ELEVATION 199.49
GROUND WATER ELEVATION 185.58 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	17"	1	2	2	4		0'-2'	TOPSOIL (4"). DARK BROWN SILTY FINE SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	14"	3	2	3	5			
		SS3	4'-6'	11"	4	6	7	9			YELLOW BROWN SILTY F-M SAND, TRACE GRAVEL. LOOSE TO DENSE. (SM) (7-65)
		SS4	6'-8'	12"	12	13	17	27			
10		SS5	8'-10'	10"	11	15	18	29		11'	
		SS6	10'-12'	8"	20	23	29	31			
		SS7	12'-13'	2"	30	41	100	/0"		13'	GRAY BROWN SILTY MEDIUM SAND, MICA, ROCK FRAGMENTS. VERY DENSE. POSSIBLE SAPROLITIC SOIL. (SM AND GM) (6-65)
20		R1	13'-23'	98% REC 30% RQD							GNEISS. LIGHT TO MEDIUM GRAY, AMPHIBOLITIC BELOW 35.5'. IN GENERAL MODERATELY HARD TO HARD WITH SOFT AND FRIABLE ZONES FROM 15' TO 16.5', 19' TO 20.75', 22.5' TO 26'. WEATHERED FROM 13' TO 26'. FOLIATION AT 40 DEGREES TO SUB-VERTICAL, MOSTLY AT 60 TO 70 DEGREES. FOLIATION INDISTINCT FROM 13' TO 15', 51.5' TO 62'.
30		R2	23'-33'	98% REC 43% RQD							
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B5-99
LINE & STA. N:323,338.35
OFFSET E:624,394.20

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START. 3-4-99
DATE. FINISH. 3-8-99

GROUND ELEVATION 199.49
GROUND WATER ELEVATION 185.58 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
										OXIDATION ON JOINTS TO 26'.
	R3	33'-43'	100 %	REC						CLOSE JOINT SPACING FROM 17.25' TO 28.6', FROM 15' TO 16.5', A SUB-VERTICAL FOLIATION JOINT, STRONGLY WEATHERED, SOFT AND FRIABLE, TIGHT. FROM 19' TO 20.75' FRACTURED ZONE, SOFT AND FRIABLE. FROM 22.5' TO 26', FRACTURED, OXIDIZED. FROM 26' TO 28.6', FOLIATION JOINTS AT 60 TO 80 DEGREES, SMOOTH, OPEN. (3-65) CLASS FROM 13' TO 28.6'.
			62% RQD							
	R4	43'-53'	100 %	REC						
			82% RQD							
	R5	53'-63'	100 %	REC						
			100 % RQD							
	R6	63'-65'	100 %	REC						
			91% RQD							
	R7	65'-75'	100 %	REC					75'	ROCK QUALITY IMPROVES AT 28.6' CLOSELY JOINTED FROM 32.25' TO 35.5'. FROM 32.5' TO TO 34.3', SEVEN FOLIATION JOINTS AT 60 DEGREES, SMOOTH, TIGHT. SMOOTH FOLIATION JOINTS AT 60 DEGREES AT 35.5', 40.5', 50.3' TO 51', 51.75', 53'. (2-65) CLASS FROM 28.6' TO 53'.
			92% RQD							

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO MG-B5-99
LINE & STA N:323,338.35
OFFSET E:624,394.20

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE _____

DATE START: 3-4-99
DATE FINISH: 3-8-99

GROUND ELEVATION 199.49
GROUND WATER ELEVATION 185.58 3/24/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
										MODERATELY CLOSE TO WIDE JOINT SPACING BELOW 53'. AT 72.3', A 40-DEGREE JOINT WITH FOLIATION TREND, CARBONATE COATING. (1-65)
										END OF HOLE 75' ORIENTED CORE FROM 65' TO 75'. PERMEABILITY TESTS IN SOIL. WATER PRESSURE TESTS IN ROCK FROM 15' TO 75'. PIEZOMETER INSTALLED AT 74'.

0
10
20
30
40

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 4
LOCATION BRONX, NY
HOLE NO MG-B6-99
LINE & STA. N:323,437.24
OFFSET E:624,405.81

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE START. 2-19-99
DATE FINISH 2-22-99

GROUND ELEVATION 195.84
GROUND WATER ELEVATION 182.65 2/23/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-2'	TOPSOIL(2"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS1	0'-2'	16"	6	5	4	5			
		SS2	2'-4'	15"	5	7	7	10			
		SS3	4'-6'	18"	8	7	11	20		8'	ORANGE BROWN SILTY F-M SAND FROM 2' TO 4', COARSE SAND FROM 4' TO 6' WITH TRACE TO LITTLE GRAVEL. SOME GRAVEL BELOW 8'. MEDIUM DENSE TO DENSE. (SM AND GM)(6-65)
		SS4	6'-8'	14"	22	38	34	37			
10		SS5	8'-10'	12"	21	29	33	37			
		SS6	10'-12'	12"	30	34	48	50		13'	YELLOW BROWN SILTY F-M SAND, SOME GRAVEL, MICA, ROCK FRAGMENTS. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
20		R1	13'-23'	89% REC 72% RQD							GNEISS. LIGHT TO MEDIUM GREEN GRAY, AMPHIBOLITIC GNEISS, MODERATELY WEATHERED TO UN-WEATHERED, MEDIUM HARD TO HARD. QUARTZITIC BANDS FROM 68' TO 72' AND FROM 73.5' TO 77'. FOLIATION AT 60 DEGREES TO SUB-VERTICAL. OXIDATION ON JOINTS TO 18'. FROM 13' TO 21', CLOSE TO MODERATELY JOINT SPACING.
30		R2	23'-33'	94% REC 81% RQD							
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 4
LOCATION BRONX, NY
HOLE NO MG-B6-99
LINE & STA N:323,437.24
OFFSET E:624,405.81

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START 2-19-99
DATE. FINISH: 2-22-99

GROUND ELEVATION 195.84
GROUND WATER ELEVATION 182.65 2/23/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											FROM 17.25' TO 18', A 70-DEGREE FOLIATION JOINT, SMOOTH, OXIDIZED, SOFT, FIABLE, TALC COATING, OPEN, INTERSECTED AT 17.6' BY A 60-DEGREE JOINT ACROSS FOLIATION AND A 20-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, OPEN.
		R3	33'-43'	100 % REC 77% RQD							
50											
10											
		R4	43'-53'	100 % REC 95% RQD							FROM 19.25' TO 19.5', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, AN 80-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, TIGHT; AND A 60-DEGREE WITH FOLIATION TREND, SMOOTH, OPEN. IN GENERAL, FAIR ROCK TO 21'. (3-65/2-65)
60											
20											
		R5	53'-63'	100 % REC 99% RQD							
70											MODERATELY CLOSE TO JOINT SPACING FROM 21' TO 43'.
30											
		R6	63'-73'	99% REC 94% RQD							AT 25.8', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT.
		R7	73'-78'	100 % REC 100 % RQD						78'	AT 28.3', A 50-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, OPEN.
80											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B6-99
LINE & STA N:323,437.24
OFFSET E:624,405.81

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE START: 2-19-99
DATE FINISH: 2-22-99

GROUND ELEVATION 195.84
GROUND WATER ELEVATION 182.65 2/23/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
										AT 28.1' TO 29.2', A SUBVERTICAL FOLIATION JOINT, IRREGULAR, SMOOTH, TIGHT, WITH A 25-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. FROM 29.8'TO 30.2', TWO 70-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT, WITH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH, OPEN. FROM 33' TO 34.8', A 75 TO 80-DEGREE JOINTS ACROSS FOLIATION, CURVED, IRREGULAR, ROUGH, TIGHT, WITH TWO 20-DEGREE JOINTS ACROSS FOLIATION, SMOOTH, TIGHT. FROM 36.8' TO 38',A 70-DEGREE FOLIATION JOINT, SMOOTH,SOFT, OPEN WITH A 10-DEGREE JOINT ACROSS FOLIATION,ROUGH, TIGHT. FROM 40.7'TO 42.2', A 75-DEGREE FOLIATION JOINT,IRREGULAR,SMOOTH,TIGHT, WITH A 50-DEGREE JOINT ACROSS FOLIATION,SMOOTH, TIGHT. (2-65)

0
10
20
30
40

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 4 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B6-99
LINE & STA. N:323,437.24
OFFSET E:624,405.81

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START. 2-19-99
DATE. FINISH: 2-22-99

GROUND ELEVATION 195.84
GROUND WATER ELEVATION 182.65
2/23/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											ROCK QUALITY IMPROVES BELOW 43', MODERATELY CLOSE TO WIDE JOINT SPACING. FROM 46.3'TO 46.8', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, WITH A 50-DEGREE JOINT ACROSS FOLIATION, SMOOTH, TIGHT. AT 64.5'. A 60-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. FROM 71.3'TO 71.8', CLOSELY JOINTED WITH SUBHORIZONTAL JOINTS, ROUGH, OPEN. (1-65)
10											
20											
											END OF HOLE 78'
30											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO MG-B7-99
LINE & STA N:322,927.76
OFFSET E:624,444.51

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-16-99
DATE. FINISH: 2-17-99

GROUND ELEVATION 193.46
GROUND WATER ELEVATION 186.06 2/23/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	16"	1	1	1	1		0'-2'	TOPSOIL(3"). DARK GRAY BROWN SANDY SILT, ORGANIC MATTER. VERY SOFT. (ML) (11-65)
	SS2	2'-4'	14"	2	6	7	7			
	SS3	4'-5'	8"	21	100	/6"				
	SS4	6'-7.4'	6"	29	47	100	/5"		8'	TAN BROWN SILTY FINE SAND, TRACE GRAVEL. MEDIUM DENSE TO VERY DENSE. (SM)(7-65)
	SS5	8'-8.4'	4"	100	/5"					
	SS6	10'-11'	4"	66	100	/6"			14'	YELLOW BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS, BOULDERS. VERY DENSE POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM)(6-65/5-65). ROLLER BIT FROM 11' TO 15'.
	R1	15'-25'	98% REC 80% RQD							GNEISS.MEDIUM GRAY. OXIDATION TO 20'. FOLIATION AT 60 DEGREES TO SUB-VERTICAL. FROM 15' TO 35' MODERATELY HARD, SLIGHTLY WEATHERED. FRACTURED FROM 15' TO 17'. AT 16.25', AN 80-DEGREE FOLIATION JOINT, ROUGH, TIGHT, OXIDIZED, WITH THREE 10-DEGREE JOINTS ACROSS FOLIATION, OPEN, ROUGH. AT 19.7', 20.6', 70-DEGREE
	R2	25'-35'	97% REC 84% RQD							

0 / 10 / 20 / 30 / 40

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B7-99
LINE & STA N:322,927.76
OFFSET E:624,444.51

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START 2-16-99
DATE. FINISH 2-17-99

GROUND ELEVATION 193.46
GROUND WATER ELEVATION 186.06 2/23/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										FOLIATION JOINTS, SMOOTH, OXIDIZED, TIGHT. AT 21.4', A 70-DEGREE JOINT WITH FOLIATION TREND, ROUGH, TIGHT, EPIDOTE. BELOW 22',5 TO 10-DEGREE JOINTS PREDOMINATE, ROUGH. (2-65)
40										
	R3	35'-45'	100 %		REC					
			100 %		RQD					
50										
10										
	R4	45'-55'	100 %		REC					VERY GOOD ROCK WITH MODERATELY CLOSE JOINT SPACING BELOW 35'.
			98%		RQD					
60										
20										
	R5	55'-65'	100 %		REC					FROM 55.3' TO 56', A SUBVERTICAL FOLIATION JOINT; ROUGH, TIGHT, WITH TWO 5 TO 10-DEGREE JOINTS ACROSS FOLIATION, OPEN, ROUGH. AT 62.5', A 70-DEGREE FOLIATION JOINT, ROUGH, TIGHT. FROM 63.2' TO 63.4', A SUBVERTICAL FOLIATION JOINT, SMOOTH, TIGHT, MICA, WITH A 60-DEGREE JOINT WITH FOLIATION TREND AT 63.4', SMOOTH,
			90%		RQD					
70										
30										
	R6	65'-75'	100 %		REC					
			98%		RQD					
80										
40										

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B7-99
LINE & STA. N:322,927.76
OFFSET E:624,444.51

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-16-99
DATE. FINISH 2-17-99

GROUND ELEVATION 193.46
GROUND WATER ELEVATION 186.06 2/23/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											OPEN. QUARTZITIC BAND FROM 82' TO 85'. FOLIATION AT 60 DEGREES TO SUB-VERTICAL. (1-65)
		R7	75'-85'	100 %		REC				85'	
				98%	RQD						END OF HOLE 85'
90											
10											
100											
20											
110											
30											
120											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO MG-B8-99
LINE & STA N:323,075.62
OFFSET E:624,463.08

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT ALL CASING OUT DATE. _____

DATE, START: 2-17-99
DATE, FINISH: 2-19-99

GROUND ELEVATION 195.42
GROUND WATER ELEVATION 186.80 2/23/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-2'	TOPSOIL (4"). DARK BROWN SILTY FINE SAND, ORGANIC MATTER. MEDIUM DENSE. (SM) (11-65)
		SS1	0'-2'	14"	9	11	15	11			
		SS2	2'-4'	13"	17	20	20	24			
		SS3	4'-4.3'	4"	100	/4"				6'	YELLOW BROWN SILTY F-M SAND, TRACE GRAVEL, COBBLES. DENSE. (SM) (7-65)
10											
		R1	6'-14'	91%	REC						GNEISS. LIGHT TO MEDIUM GRAY, SLIGHTLY SCHISTOSE FROM 6' TO 15'. FOLIATION AT 50 DEGREES TO SUBVERTICAL. OXIDATION ON JOINTS TO 26.5'.
				35%	RQD						
20											FROM 8.5' TO 15', FRACTURED ZONE, STRONGLY OXIDIZED AND WEATHERED, WITH A SUBVERTICAL FOLIATION JOINT FROM 12' TO 14', OPEN, INTERSECTED BY SIX SUBHORIZONTAL JOINTS ACROSS FOLIATION. A 60-DEGREE JOINT ACROSS FOLIATION AT 15', OXIDIZED, SMOOTH, TIGHT. (3-65/4-65)
		R2	14'-24'	96%	REC						
				92%	RQD						
30											
		R3	24'-34'	100	%	REC					
				100	%	RQD					
40											

Soil Engineer: _____ Driller: GUS SURI

Drilling Inspector: _____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B8-99
LINE & STA N:323,075.62
OFFSET E:624,463.08

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE. _____

DATE. START: 2-17-99
DATE. FINISH: 2-19-99

GROUND ELEVATION 195.42
GROUND WATER ELEVATION 186.80 2/23/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
		R4	34'-44'	99% REC							BELOW 15', MODERATELY CLOSE JOINT SPACING TO 24'. MODERATELY CLOSE TO WIDE SPACING BELOW 24'.
				95% RQD							
50											AT 19', A 60-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT.
10											
		R5	44'-54'	99% REC							AT 25', 26.5' AND 27.25', THREE 70-DEGREE JOINTS ACROSS FOLIATION, TIGHT, SMOOTH, OXIDIZED TO 26.5'.
				97% RQD							
60											AT 59', A 60-DEGREE FOLIATION JOINT, SMOOTH, TIGHT.
20											IN GENERAL, VERY GOOD ROCK BELOW 24'. (1-65)
		R6	54'-64'	98% REC							
				93% RQD							
70											
30											
		R7	64'-74'	99% REC							
				98% RQD							
80											
40											

Soil Engineer: _____ Driller: GUS SURI

Drilling Inspector: _____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B8-99
LINE & STA. N:323,075.62
OFFSET E:624,463.08

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-17-99
DATE. FINISH: 2-19-99

GROUND ELEVATION 195.42
GROUND WATER ELEVATION 186.80 2/23/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
		R8	74'-84'	100 %	REC					84'	
				96%	RQD						END OF HOLE 84'
90											
10											
100											
20											
110											
30											
120											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 4
LOCATION BRONX, NY
HOLE NO MG-B9-99
LINE & STA N:323,275.41
OFFSET E:624,486.52

DEPTH ____ FT. ____ FT CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START 2-15-99
DATE. FINISH 2-16-99

GROUND ELEVATION 198.13
GROUND WATER ELEVATION 190.87 2/17/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE ____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24 SAMPLER 30

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	12"	4	5	4	3		0'-2'	TOPSOIL(6")DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE.(SM) (11-65)
	SS2	2'-4'	14"	4	5	4	3			
	SS3	4'-6'	14"	27	35	43	100	/4"	5'	BROWN SILTY FINE SAND, TRACE FINE TO MEDIUM GRAVEL. LOOSE TO VERY DENSE.(SM) (7-65)
	SS4	6'-8'	10"	10	17	24	37			
	SS5	8'-10'	12"	14	24	30	31			
	SS6	12'-12'1"	1"	100	/2"				13'	TAN BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS (GNEISS). VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65)
	R1	13'-18'	100 % 88% RQD		REC					GNEISS. MEDIUM GRAY, HARD, SLIGHTLY WEATHERED TO UNWEATHERED, OXIDATION ON JOINTS TO 25', AT 41', 61.5', AND 85.5'. FOLIATION AT 60 DEGREES TO SUB-VERTICAL FROM 13' TO 30' AND BELOW 45'; AT 50 DEGREES FROM 30' TO 45'. MODERATELY CLOSE JOINT SPACING FROM 13' TO 30' WITH SOME FOLIATION JOINTS AND SUB-HORIZONTAL TO 60-DEGREE JOINTS ACROSS FOLIATION.
	R2	18'-28'	100 % 88% RQD		REC					
	R3	28'-38'	100 % 95% RQD		REC					

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 4
LOCATION BRONX, NY
HOLE NO MG-B9-99
LINE & STA N:323,275.41
OFFSET E:624,486.52

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-15-99
DATE. FINISH: 2-16-99

GROUND ELEVATION 198.13
GROUND WATER ELEVATION 190.87 2/17/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE ____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24 SAMPLER 30

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											OXIDIZED.
40											FROM 13' TO 13.6', A SUBVERTICAL FOLIATION JOINT, OXIDIZED, ROUGH, TIGHT.
		R4	38'-48'	100 % REC							AT 19.8', A 60-DEGREE FOLIATION JOINT, OXIDIZED, SMOOTH, TIGHT WITH A 50-DEGREE JOINT ACROSS FOLIATION, ROUGH, OPEN.
50				95% RQD							AT 21.8', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, EPIDOTE, MICA WITH A 50-DEGREE JOINT WITH FOLIATION TREND, ROUGH, TIGHT, EPIDOTE.
10											AT 24.4', A 60-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, SMOOTH, TIGHT. (2-65)
		R5	48'-58'	100 % REC							MODERATELY CLOSE TO WIDE JOINT SPACING FROM 30' TO 76'. BELOW 38', 10-DEGREE JOINTS PREDOMINATE.
60				98% RQD							AT 34.5', A 60-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, TIGHT.
20											
		R6	58'-68'	100 % REC							
70				98% RQD							
30											
		R7	68'-78'	100 % REC							
80				90% RQD							
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 4
LOCATION BRONX, NY
HOLE NO MG-B9-99
LINE & STA. N:323,275.41
OFFSET E:624,486.52

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-15-99
DATE. FINISH: 2-16-99

GROUND ELEVATION 198.13
GROUND WATER ELEVATION 190.87 2/17/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE ____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24 SAMPLER 30

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											AT 36.3', A 60-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, MICA. AT 59.2', A 60-DEGREE FOLIATION JOINT, IRREGULAR, ROUGH, TIGHT. FROM 73.5' TO 74.8', A SUBVERTICAL FOLIATION JOINT, ROUGH, OPEN WITH TWO 70-DEGREE JOINTS ACROSS FOLIATION, ROUGH, TIGHT. (1-65)
		R8	78'-88'	97% REC						88'	
90				74% RQD							
10											
100											CLOSE TO MODERATELY CLOSE JOINT SPACING BELOW 76'. CLOSELY JOINTED FROM 76.3' TO 78' WITH 5 TO 10-DEGREE JOINTS PREDOMINANT. FROM 81.5' TO 83', A SUBVERTICAL FOLIATION JOINT, SMOOTH, CURVED, TIGHT WITH TWO 10-DEGREE JOINTS ACROSS FOLIATION, TIGHT, ROUGH.
20											
110											FROM 85' TO 86.2', A SUBVERTICAL JOINT WITH FOLIATION, OXIDIZED, ROUGH, TIGHT, WITH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH,
30											
120											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 4 OF 4
LOCATION BRONX, NY
HOLE NO. MG-B9-99
LINE & STA. N:323,275.41
OFFSET E:624,486.52

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE, START 2-15-99
DATE, FINISH 2-16-99

GROUND ELEVATION 198.13
GROUND WATER ELEVATION 190.87
2/17/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE _____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24 SAMPLER 30

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											TIGHY AND A VERTICAL FOLIATION JOINT, SMOOTH, TIGHT.
											FAIR TO GOOD ROCK. (3-65/2-65)
											END OF HOLE 88'
10											
20											
30											
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B10-99
LINE & STA. N:323,422.92
OFFSET E:624,505.15

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START. 2-18-99
DATE. FINISH: 2-19-99

GROUND ELEVATION 193.13
GROUND WATER ELEVATION 186.22 2/22/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-2'	TOPOSIL (3"). DARK GRAY BROWN SANDY SILT, ORGANIC MATTER. STIFF. (ML) (11-65)
		SS1	0'-2'	9"	3	5	5	7			
		SS2	2'-4'	11"	5	4	6	7			
		SS3	4'-6'	14"	11	15	17	30		8'	RUSTY BROWN SILTY SAND, TRACE TO SOME GRAVEL, SOME ROCK FRAGMENTS BELOW 6'. DENSE. (SM AND GM) (6-65)
		SS4	6'-7.5'	12"	15	27	100	/6"			
10											
		R1	8'-18'	98% REC 89% RQD							GNEISS. LIGHT GRAY TO MEDIUM GRAY, SLIGHTLY WEATHERED ON UPPER 6 FEET; SLIGHTLY WEATHERED TO UNWEATHERED THE REST. SOME OXIDATION ON JOINTS TO 54.2'. MODERATELY HARD TO HARD. QUARTZITIC FROM 14' TO 30.5', 36' TO 40.5'.
20											
		R2	18'-28'	100 % REC 91% RQD							FOLIATION AT 60 DEGREES TO SUB-VERTICAL. IN GENERAL, MODERATELY CLOSE JOINT SPACING.
30											
		R3	28'-38'	98% REC 93% RQD							FROM 8' TO 15', PREDOMINANT JOINTS ARE 30-DEGREE JOINTS ACROSS FOLIATION.
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B10-99
LINE & STA N:323,422.92
OFFSET E:624,505.15

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-18-99
DATE. FINISH: 2-19-99

GROUND ELEVATION 193.13
GROUND WATER ELEVATION 186.22 2/22/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											FROM 15' TO 36', PREDOMINANT JOINTS ARE 60-DEGREE FOLIATION JOINTS.
		R4	38'-48'	100 %		REC					AT 26.8' AND 27.5', TWO 60-DEGREE FOLIATION JOINTS, SMOOTH, MICA.
50				100 %		RQD					AT 34', A 60-DEGREE FOLIATION JOINT STRONGLY OXIDIZED, SMOOTH.
10											
											FROM 36' TO 50', PREDOMINANT JOINTS ARE 30-DEGREE JOINTS ACROSS FOLIATION. PYRITE PRESENT THROUGHOUT.
		R5	48'-58'	100 %		REC					
60				100 %		RQD					
20											
											FROM 50' TO 69', PREDOMINANT JOINTS ARE 30 TO 60-DEGREE JOINTS ALONG FOLIATION. AT 53.3', A 50-DEGREE FOLIATION JOINT, SMOOTH, MICA. AT 54.2', A 50-DEGREE FOLIATION JOINT, OXIDIZED, SMOOTH. FROM 67.2' TO 68', A 60-DEGREE FOLIATION JOINT, FRIABLE, SOFT, CHLORITE. POSSIBLE SHEAR WITH
		R6	58'-68'	100 %		REC					
70				90%		RQD					
30											
		R7	68'-78'	96%		REC				78'	
80				88%		RQD					
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B10-99
LINE & STA. N:323,422.92
OFFSET E:624,505.15

DEPTH _____ FT ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-18-99
DATE. FINISH: 2-19-99

GROUND ELEVATION 193.13
GROUND WATER ELEVATION 186.22 2/22/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I D _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											A 30-DEGREE JOINT ACROSS FOLIATION, SMOOTH, CHLORITE. FROM 68.7' TO 69', A 60-DEGREE FOLIATION JOINT, SMOOTH, CHLORITE. BELOW 69', 20 TO 30-DEGREE JOINTS ACROSS FOLIATION PREDOMINATE. FROM 76.2'TO 77.5', A 70-DEGREE FOLIATION JOINT, SMOOTH, EPIDOTE, CHLORITE WITH A 20-DEGREE JOINT ACROSS FOLIATION, ROUGH. IN GENERAL, GOOD ROCK. (1-65)
10											
20											
30											END OF HOLE 78'
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B11-99
LINE & STA. N:322,906.15
OFFSET E:624,542.71

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE _____

DATE. START: 3-12-99
DATE. FINISH: 3-16-99

GROUND ELEVATION 194.92
GROUND WATER ELEVATION _____

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	ANGLED BOREHOLE: DIRECTION N 8 DEGREES E ANGLE 60 DEGREES ROLLER BIT TO TOP OF ROCK NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL
10										10'	GNEISS. MEDIUM GRAY. SCHISTOSE, AMPHIBOLITIC BANDS, MODERATELY HARD TO HARD, FAIRLY WEATHERED TO UN-WEATHERED. FOLIATION VARIES FROM 50 DEGREES TO SUBVERTICAL, MOSTLY AT 70 DEGREES. OXIDATION ON JOINTS TO 17'. FRACTURED FROM 10' TO 17'. FROM 14' TO 15', AN 80-DEGREE FOLIATION JOINT, SOFT, OXIDIZED, ROUGH, OPEN. (3-65) MODERATLEY CLOSE JOINT SPACING FROM 17' TO 55'. FROM 21.75' TO 22.5', AN 80-DEGREE FOLIATION JOINT, ROUGH, TIGHT.
20		R1	10'-20'	99% REC 74% RQD							
30		R2	20'-30'	98% REC 97% RQD							
40		R3	30'-40'	100 % REC 91% RQD							

Soil Engineer: _____ Driller: GREG MARNEY JR.

Drilling Inspector: _____ Helper: THEO RODRIGUEZ

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B11-99
LINE & STA N:322,906.15
OFFSET E:624,542.71

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE, START: 3-12-99
DATE, FINISH. 3-16-99

GROUND ELEVATION 194.92
GROUND WATER ELEVATION _____

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											AT 32.5', A 50-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, TIGHT, ALTERATION IN EPIDOTE. FROM 48' TO 48.5', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT.
50											
10		R4	40'-50'	98% REC 90% RQD							AT 51', A 30-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, TIGHT. AT 52', A 30-DEGREE JOINT ACROSS FOLIATION, SMOOTH, TIGHT. AT 53', A 30-DEGREE JOINT ACROSS FOLIATION ROUGH, TIGHT, CARBONATE COATING. (2-65)
60											
20		R5	50'-60'	100 % REC 94% RQD							MODERATELY CLOSE TO WIDE JOINT SPACING BELOW 55'. AT 61.8', A 60-DEGREE JOINT ACROSS FOLIATION, ROUGH, ALTERATION IN CHLORITE, CARBONATE COATING. FROM 65.5' TO 65.8', AT 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT.
70											
30		R6	60'-70'	98% REC 85% RQD							
80		R7	70'-80'	96% REC 76% RQD							
40											

Soil Engineer: _____ Driller: GREG MARNEY JR.

Drilling Inspector: _____ Helper: THEO RODRIGUEZ

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B11-99
LINE & STA N:322,906.15
OFFSET E:624,542.71

DEPTH _____ FT. ____ FT. CASING OUT DATE. _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START. 3-12-99
DATE. FINISH: 3-16-99

GROUND ELEVATION 194.92
GROUND WATER ELEVATION _____

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											FROM 70' TO 70.8', TWO FOLIATION JOINTS AT 70 DEGREES, ROUGH, OPEN, ALTERATION IN CHLORITE. FROM 74.5' TO 75.6', AN 80-DEGREE JOINT ACROSS FOLIATION, ROUGH, OPEN, ALTERATION IN CHLORITE. FROM 84' TO 85', A 75-DEGREE FOLIATION JOINT, ROUGH, TIGHT, ALTERATION IN CHLORITE. FROM 95.2' TO 96', AN 80-DEGREE FOLIATION JOINT, SMOOTH, SOME CARBONATE COATING. (1-65)
90											
10		R8	80'-90'	98% REC 88% RQD							
100											
20		R9	90'-100'	98% REC 96% RQD							
		R10	100'-105'	100 % REC 100 % RQD						105'	
110											END OF HOLE 105'
30											
120											
40											

Soil Engineer: _____ Driller: GREG MARNEY JR.

Drilling Inspector: _____ Helper: THEO RODRIGUEZ

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO MG-B12-99
LINE & STA N:323,064.12
OFFSET E:624,562.82

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE. START: 2-16-99
DATE. FINISH: 2-17-99

GROUND ELEVATION 195.19
GROUND WATER ELEVATION 186.39 2/22/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-2'	TOPSOIL (4"). DARK GRAY SILTY SAND, ORGANIC MATTER. LOOSE TO MEDIUM DENSE. (SM) (11-65)
		SS1	0'-2'	12"	2	2	3	4			
		SS2	2'-4'	14"	3	4	6	6			
		SS3	4'-6'	15"	6	8	10	11		7'	RUSTY BROWN SILTY FINE SAND, TRACE TO SOME GRAVEL. MEDIUM DENSE. (SM) (6-65)
		SS4	6'-6.7'	4"	63	100	/2"				
		SS5	8'-8.2'	2"	100	/3"					
10										12'	TAN BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS (GNEISS), COBBLES. VERY DENSE. POSSIBLY SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65) ROLLER BIT FROM 8.2' TO TOP OF ROCK
		R1	12'-17'	100 %	REC						
				50%	RQD						
20											GNEISS. MEDIUM GRAY, MODERATELY HARD TO HARD, MODERATELY WEATHERED TO UN-WEATHERED. OXIDATION ON JOINTS TO 26.5'. QUARTZITIC BANDS FROM 12' TO 14'; 26' TO 27.5'. FOLIATION AT 70 DEGREES TO SUB-VERTICAL AND AT 50 DEGREES FROM 40' TO 55' AND 65' TO 71'.
		R2	17'-24.5'	96%	REC						
				49%	RQD						
30											
		R3	24.5'-32'	100 %	REC						
				93%	RQD						
40											FRACTURED AND OXIDIZED FROM 12' TO 14.5' AND FROM 17' TO 24.5', WITH CLOSELY SPACED

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B12-99
LINE & STA N:323,064.12
OFFSET E:624,562.82

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START. 2-16-99
DATE. FINISH: 2-17-99

GROUND ELEVATION 195.19
GROUND WATER ELEVATION 186.39 2/22/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											JOINTS.
		R4	32'-42'	100 %		REC					
				95%	RQD						FOLIATION JOINTS PREDOMINATE TO 14.5', SUBHORIZONTAL JOINTS PREDOMINATE FROM 14.5' TO 27'. FROM 23.5' TO 24.2', A 70-DEGREE FOLIATION JOINT, OXIDIZED, SMOOTH, OPEN WITH TWO 5 TO 10-DEGREE JOINTS, OPEN, ROUGH. (3-65) ROCK QUALITY IMPROVES BELOW 27', UNWEATHERED, MODERATELY CLOSE TO WIDE JOINT SPACING.
50											
10											
		R5	42'-52'	100 %		REC					
				93%	RQD						
60											
20											
		R6	52'-62'	100 %		REC					AT 46.5', AN 80-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, CHLORITE.
				98%	RQD						
70											AT 75.7', A 60-DEGREE FOLIATION JOINT, ROUGH, OPEN AND A 60-DEGREE JOINT ACROSS FOLIATION, SMOOTH, OPEN.
30											
		R7	62'-71'	98%	REC						AT 76.9', A 60-DEGREE FOLIATION JOINT, ROUGH, TIGHT.
				98%	RQD						
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B12-99
LINE & STA. N:323,064.12
OFFSET E:624,562.82

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-16-99
DATE. FINISH 2-17-99

GROUND ELEVATION 195.19
GROUND WATER ELEVATION 186.39 2/22/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		R8	71'-81.5'	96%	REC					81.5'	AT 77.5', A 60-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, TIGHT, CHLORITE. AT 77.8', A 40-DEGREE JOINT WITH FOLIATION TREND, ROUGH, TIGHT. AT 79.2', A 60-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, CHLORITE, EPIDOTE, TIGHT. FROM 81' TO 81.5', A SUBVERTICAL FOLIATION JOINT, SMOOTH, TIGHT. (1-65)
80				86%	RQD						
90											
10											
100											
20											
110											END OF HOLE 81.5'
30											
120											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B13-99
LINE & STA N:323,264.15
OFFSET E:624,587.04

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START: 2-10-99
DATE. FINISH 2-11-99

GROUND ELEVATION 195.97
GROUND WATER ELEVATION 186.81 2/15/99

CASING O.D. HW ____ I.D ____
SAMPLER O.D. 2" ____ I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-2'	TOPSOIL (4"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS1	0'-2'	12"	4	4	3	2			
		SS2	2'-4'	14"	7	5	6	7			
		SS3	4'-6'	4"	11	15	49	60		7'	RUSTY BROWN SILTY FINE SAND, TRACE FINE TO MEDIUM GRAVEL. MEDIUM DENSE TO VERY DENSE. (SM) (7-65)
10											
		R1	7'-13'	100 %	REC						GNEISS. MEDIUM GRAY, HARD, GENERALLY UNWEATHERED. OXIDATION ON JOINTS TO 42'.
				98%	RQD						
20											
		R2	13'-23'	98%	REC						FOLIATION AT 60 TO 80 DEGREES FROM 7' TO 30'; AT 20 TO 50 DEGREES FROM 30' TO 40' AND 50' TO 60'; AT 70 DEGREES TO SUBVERTICAL FROM 40' TO 50' AND BELOW 60'.
				94%	RQD						
30											
		R3	23'-33'	100 %	REC						IN GENERAL, MODERATELY CLOSE TO WIDE FRACTURE SPACING; MODERATELY CLOSE TO CLOSE FROM 40' TO 50'. SUBHORIZONTAL JOINTS PREDOMINATE.
				88%	RQD						
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B13-99
LINE & STA. N:323,264.15
OFFSET E:624,587.04

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START 2-10-99
DATE. FINISH 2-11-99

GROUND ELEVATION 195.97
GROUND WATER ELEVATION 186.81 2/15/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
		R4	33'-43'	100 %	REC						AT 19', A 60-DEGREE FOLIATION JOINT, OXIDIZED, ROUGH, TIGHT. AT 28.5', A 60-DEGREE JOINT ACROSS THE FOLIATION, OXIDIZED, ROUGH, TIGHT. AT 43', AT 60-DEGREE JOINT WITH FOLIATION TREND, ROUGH, TIGHT, CHLORITE ALTERATION. AT 45', A 60-DEGREE FOLIATION JOINT, ROUGH, IRREGULAR, TIGHT. FROM 43' TO 45', ROCK IS JOINTED WITH JOINTS 7" APART. GOOD ROCK BELOW 45'. FROM 76' TO 77.5', A SUB-VERTICAL JOINT ACROSS FOLIATION, IRREGULAR, TIGHT, ROUGH. (1-65)
				95% RQD							
50											
10											
		R5	43'-53'	100 %	REC						
				83% RQD							
60											
20											
		R6	53'-63'	100 %	REC						
				91% RQD							
70											
30											
		R7	63'-73'	99% REC							
				95% RQD							
80											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO MG-B13-99
LINE & STA. N:323,264.15
OFFSET E:624,587.04

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-10-99
DATE. FINISH: 2-11-99

GROUND ELEVATION 195.97
GROUND WATER ELEVATION 186.81
2/15/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
		R8	73'-83'	98%	REC					83'	
				88%	RQD						END OF HOLE 83'
90											
10											
100											
20											
110											
30											
120											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO MG-B14-99
LINE & STA. N:323,436.44
OFFSET E:624,605.98

DEPTH _____ FT ____ FT. CASING OUT DATE _____
DEPTH _____ FT. ALL CASING OUT DATE _____

DATE. START 3-1-99
DATE. FINISH: 3-3-99

GROUND ELEVATION 190.53
GROUND WATER ELEVATION _____

CASING O.D. HW I D _____
SAMPLER O.D. 2" I D _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300 LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	ANGLED BOREHOLE DIRECTION: S 8 DEGREES W ANGLE: 60 DEGREES. NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL)
		R1	9'-15'	93% REC 82% RQD						9'	GNEISS. LIGHT TO MEDIUM GRAY. QUARTZITIC FROM 15' TO 18.5', 58' TO 61', 80' TO 86', 90.5' TO 91.5' (BAND); BIOTITE GNEISS FROM 74.5' TO 80'. FOLIATION VARIABLE FROM 40 DEGREES TO VERTICAL. OXIDATION ON JOINTS TO 32'.
20		R2	15'-25'	91% REC 83% RQD							FROM 15' TO 29' AND 35' TO 45', 20 TO 30 AND 60-DEGREE JOINTS ACROSS FOLIATION ARE PREDOMINANT, ROUGH, OXIDIZED, TIGHT. AT 26.5', A 60-DEGREE FOLIATION JOINT, ROUGH, TIGHT. CLOSELY JOINTED FROM 23' TO 27.5'; MODERATELY JOINTED FROM 9' TO 23' AND 27.5' TO 98.5'.
30		R3	25'-35'	100 % REC 90% RQD							
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B14-99
LINE & STA. N:323,436.44
OFFSET E:624,605.98

DEPTH _____ FT ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 3-1-99
DATE. FINISH: 3-3-99

GROUND ELEVATION 190.53
GROUND WATER ELEVATION _____

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300 LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
		R4	35'-45'	100 %	REC						
				99%	RQD						
50											
10											
		R5	45'-55'	96%	REC						
				76%	RQD						
60											
20											
		R6	55'-65'	98%	REC						
				95%	RQD						
70											
30											
		R7	65'-75'	100 %	REC						
				82%	RQD						
80											
40											

AT 30.1', 32', 32.8', 43' AND 46.3', 60-DEGREE FOLIATION JOINTS, ROUGH, OXIDIZED, TIGHT.
AT 31.25', A 20-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT.
AT 45.25', A SUB-VERTICAL JOINT ACROSS FOLIATION, IRREGULAR, ROUGH, CARBONATE COATING, OPEN.
AT 48.7', A 50-DEGREE JOINT ACROSS FOLIATION, SMOOTH, TIGHT, EPIDOTE, CARBONATE COATING.
FROM 54.5' TO 55.5', TWO FOLIATION JOINTS, SMOOTH, TIGHT.
AT 58.8', A 40-DEGREE JOINT ACROSS FOLATION, SMOOTH, TIGHT.
FROM 68' TO 68.2', SOFT, FRIABLE, ALONG A 40-DEGREE JOINT ACROSS FOLIATION OPEN.
CLOSELY JOINTED FROM 98.5' TO 105'.

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B14-99
LINE & STA. N:323,436.44
OFFSET E:624,605.98

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 3-1-99
DATE. FINISH: 3-3-99

GROUND ELEVATION 190.53
GROUND WATER ELEVATION ____

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300 LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
		R8	75'-85'	93% REC 97% RQD							AT 92' AND 93.5', TWO FOLIATION JOINTS AT 60 DEGREES, CHLORITIC ALTERATION, TIGHT. AT 103', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT. AT 104.5', A SUB-VERTICAL JOINT WITH FOLIATION TREND, IRREGULAR, ROUGH, OPEN, CARBONATE COATING. (2-65)
90											
-10											
		R9	85'-95'	100 % REC 100 % RQD							
100											
-20											
		R10	95'-105'	100 % REC 70% RQD						105'	
110											END OF HOLE 105'
-30											
120											
-40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN & SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B15-99
LINE & STA N:322,903.09
OFFSET E:624,644.07

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE START: 2-10-99
DATE FINISH: 2-11-99

GROUND ELEVATION 195.56
GROUND WATER ELEVATION 187.14 2/15/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	18"	3	2	2	2		0'-	TOPSOIL (4"). RUSTY BROWN SILTY SAND, ORGANIC MATTER FROM 0' TO 2' (11-65). LOOSE FROM 2' TO 4'. (SM) (7-65)
		SS2	2'-4'	18"	3	4	3	4		4'	
		SS3	4'-6'	18"	7	12	12	15			
		SS4	6'-6.7'	6"	19	100	/1"				RUSTY BROWN SILTY SAND, TRACE GRAVEL TO 9', WITH ROCK FRAGMENTS BELOW 9'. MEDIUM DENSE TO DENSE. (SM) (6-65)
10		SS5	8'-10'	12"	12	38	100	/2"	WASH	11'	
20		R1	11'-21'	99% REC 77% RQD							GNEISS. MEDIUM GRAY, MODERATELY HARD TO HARD. QUARTZITIC BANDS, SLIGHTLY WEATHERED FROM 11' TO 19'. OXIDATION ON JOINTS TO 17.5'. FOLIATION AT 70 DEGREES TO SUBVERTICAL FROM 11' TO 21' AND BELOW 69'; AT 45 DEGREES FROM 33' TO 40'; INDISTINCT FROM 21' TO 33', 40' TO 69'.
30		R2	21'-31'	99% REC 92% RQD							CLOSE TO MODERATELY CLOSE JOINT SPACING FROM 11' TO 19'. SOME OXIDATION ON FOLIATION AND SUB-HORIZONTAL JOINTS. SHEARING ALONG A SUBHORIZONTAL JOINT FROM 12.5' TO 13' WITH CHLORITE AND HEMATITE STAINING
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN & SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B15-99
LINE & STA. N:322,903.09
OFFSET E:624,644.07

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-10-99
DATE. FINISH: 2-11-99

GROUND ELEVATION 195.56
GROUND WATER ELEVATION 187.14 2/15/99

CASING O.D. HW ____ I.D. ____
SAMPLER O.D. 2" ____ I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		R3	31'-41'	99% REC							AND FITTED CORE SURFACE. FROM 13' TO 14', A 75-DEGREE JOINT ACROSS FOLIATION, OXIDIZED. (2-65)
40				93% RQD							
50											MODERATELY CLOSE TO WIDE JOINT SPACING BELOW 19'.
10		R4	41'-51'	99% REC							
				99% RQD							IN GENERAL, THE ROCK IS VERY GOOD BELOW 19'. (1-65)
60											
20		R5	51'-61'	99% REC							
				98% RQD							
70											
30		R6	61'-71'	99% REC							
				98% RQD							
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN & SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B15-99
LINE & STA. N:322,903.09
OFFSET E:624,644.07

DEPTH ____ FT ____ FT. CASING OUT DATE. ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START 2-10-99
DATE. FINISH 2-11-99

GROUND ELEVATION 195.56
GROUND WATER ELEVATION 187.14 2/15/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		R7	71'-81'	99%	REC					81'	
80				98%	RQD						
											END OF HOLE 81'
90											
10											
100											
20											
110											
30											
120											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B16-99
LINE & STA. N:323,151.70
OFFSET E:624,674.92

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE, START 2-8-99
DATE, FINISH 2-9-99

GROUND ELEVATION 194.87
GROUND WATER ELEVATION 183.19 2/10/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	TOPSOIL (6"). DARK
		SS1	0'-2'	12"	2	3	3	4		2'	BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	14"	4	7	8	8			
		SS3	4'-6'	10"	9	11	27	100 /4"			RUSTY BROWN SILTY SAND, TRACE GRAVEL TO 4', SOME GRAVEL
		SS4	6'-8'	10"	8	17	21	24		8'	FROM 4' TO 8'. MEDIUM DENSE TO DENSE. (SM) (6-65)
		SS5	8'-8.3'	3"	100	/4"				9.5'	YELLOW BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
10											
20		R1	10'-20'	90% REC 60% RQD							GNEISS. MEDIUM GRAY MODERATELY HARD TO HARD. FOLIATION AT 70 DEGREES TO SUB-VERTICAL.
30		R2	20'-30'	98% REC 96% RQD							MODERATELY WEATHERED TO 15.5' WITH SOME OXIDATION ON FOLIATION AND SUBHORIZONTAL JOINTS. PITTED CORE SURFACE FROM 11' TO 25'. (3-65)
		R4	30'-40'	99% REC 95% RQD							
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B16-99
LINE & STA N:323,151.70
OFFSET E:624,674.92

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-8-99
DATE. FINISH: 2-9-99

GROUND ELEVATION 194.87
GROUND WATER ELEVATION 183.19 2/10/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
50											
10		R4	40'-50'	99% REC 99% RQD							ROCK QUALITY IMPROVES BELOW 15.5'. MODERATELY CLOSE TO WIDE JOINT SPACING. A FEW SUB-HORIZONTAL JOINTS ACROSS FOLIATION. GOOD ROCK. (1-65)
60											
20		R5	50'-60'	99% REC 97% RQD							
70											
30		R6	60'-70'	99% REC 97% RQD							
80		R7	70'-80'	99% REC 92% RQD						80'	END OF HOLE 80'
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO MG-B17-99
LINE & STA N:323,420.47
OFFSET E:624,708.49

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-25-99
DATE. FINISH: 3-2-99

GROUND ELEVATION 192.33
GROUND WATER ELEVATION 185.54 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
		SS1	0'-2'	18"	9	10	27	54		0'-2'	DARK BROWN SILTY F-M SAND AND DARK SILTY SAND WITH SILT, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-	6"	64	100	/5"			4'	DARK GRAY SILTY F-C SAND, MICA, COBBLES, ROCK FRAGMENTS. VERY DENSE. POSSIBLE SAPROLITIC SOIL. (SM AND GM) (6-65)
10		R1	4'-14'	97% REC 77% RQD							GNEISS. MEDIUM GRAY, MODERATELY HARD TO HARD, QUARTZITIC FROM 42' TO 52'. FAINTLY WEATHERED TO UN-WEATHERED. FOLIATION VARIES FROM 75 TO 85 DEGREES FROM 4' TO 10'; 50 DEGREES FROM 10' TO 14'; 30 TO 60 DEGREES FROM 14' TO 19'; 40 DEGREES FROM 19' TO 24'; 30 TO 70 DEGREES FROM 26' TO 42'; 50 TO 80 DEGREES FROM 52' TO 70.5'; INDISTINCT FOLIATION FROM 42' TO 52' AND BELOW 70.5'.
20		R2	14'-24'	100 % REC 77% RQD							OXIDATION ON JOINTS TO 18'.
30		R3	24'-34'	98% REC 93% RQD							
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B17-99
LINE & STA N:323,420.47
OFFSET E:624,708.49

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE. START: 2-25-99
DATE. FINISH: 3-2-99

GROUND ELEVATION 192.33
GROUND WATER ELEVATION 185.54 3/24/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											MODERATELY CLOSE TO CLOSE JOINT SPACING FROM 4' TO 19' WITH SEVERAL OPEN JOINTS, OXIDIZED, MOSTLY ROUGH. CLOSE TO WIDE JOINT SPACING BELOW 19'.
		R4	34'-44'	98%	REC						
				95%	RQD						
50											
10											FROM 10' TO 12.25', IRREGULAR FOLIATION JOINT AT 75 DEGREES TO VERTICAL TO 50 DEGREES, OXIDIZED, OPEN, ROUGH. AT 15.3', A 60-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, ALTERED IN CHLORITE AND COATED WITH CARBONATE, SMOOTH. (2-65) ROCK CLASS FROM 4' TO 19'.
		R5	44'-54'	100 %	REC						
				98%	RQD						
60											
20											
		R6	54'-64'	99%	REC						
				99%	RQD						
70											AT 19' TO 20.1', TWO FOLIATION JOINTS AT 40 DEGREES, SMOOTH, TIGHT. AT 24.2', 24.9', 40 AND 60-DEGREE JOINTS, SMOOTH, TIGHT, WITH EPIDOTE ALTERATION AND CARBONATE COATING. AT 39.7', A 20-DEGREE JOINT ACROSS FOLIATION, SMOOTH, TIGHT, WITH
30											
		R7	64'-74'	100 %	REC					74'	
				97%	RQD						
80											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B17-99
LINE & STA N:323,420.47
OFFSET E:624,708.49

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-25-99
DATE. FINISH 3-2-99

GROUND ELEVATION 192.33
GROUND WATER ELEVATION 185.54
3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											CHLORITE AND EPIDOTE ALTERATION. AT 43', A 10-DEGREE JOINT, SMOOTH, OPEN. AT 51.3', A 50-DEGREE JOINT, SMOOTH, TIGHT, WITH CARBONATE COATING. AT 53', A 10-DEGREE JOINT, SMOOTH, TIGHT, WITH CARBONATE COATING. AT 67', A 50-DEGREE FOLIATION JOINT, SMOOTH, TIGHT.
											ROCK BELOW 19' IS GENERALLY GOOD, MASSIVE. (1-65)
10											
20											END OF HOLE 74'
											ORIENTED CORE FROM 15' TO 74'. WATER PRESSURE TESTS IN ROCK FROM 5' TO 74'. PIEZOMETER INSTALLED AT 68.5'.
30											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B18-99
LINE & STA N:322,893.84
OFFSET E:624,742.15

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-26-99
DATE. FINISH: 3-2-99

GROUND ELEVATION 194.72
GROUND WATER ELEVATION 185.86 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	DARK BROWN SILTY FINE SAND, ORGANIC
		SS1	0'-2'	12"	3	3	4	4		3'	MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	9"	4	5	6	6			
		SS3	4'-6'	7"	3	3	4	9		6'	BROWN TO YELLOW BROWN SILTY F-M SAND. MEDIUM DENSE. (SM) (7-65)
		SS4	6'-8'	3"	15	19	23	35			
10		SS5	8'-10'	6"	9	11	27	31			BROWN SILTY F-M SAND WITH SOME GRAVEL. DENSE. (SM) (6-65)
										15'	
											GNEISS. MEDIUM GRAY, HARD. QUARTZITIC BANDS FROM 69.5' TO 75.5'. SLIGHTLY WEATHERED TO UN-WEATHERED. FOLIATION AT 70-DEGREE TO SUB-VERTICAL FROM 15' TO 40',70'TO 80'; AT 30 TO 50 DEGREES FROM 40' TO 70'.
20		R1	15'-20'	95%	REC						
				60%	RQD						
30		R2	20'-30'	100	%	REC					OXIDATION ON JOINTS TO 26.3'. CLOSE TO MODERATELY CLOSE JOINT SPACING. NUMEROUS SUB-HORIZONTAL JOINTS ACROSS FOLIATON, MOSTLY ROUGH. BELOW 40', 40 TO 80 DE-GREE JOINTS (FOLIA-TION) AND ACROSS
				63%	RQD						
		R3	30'-40'	99%	REC						
40				83%	RQD						

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B18-99
LINE & STA N:322,893.84
OFFSET E:624,742.15

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE, START 2-26-99
DATE, FINISH 3-2-99

GROUND ELEVATION 194.72
GROUND WATER ELEVATION 185.86 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											FOLIATION) PRE-DOMINATE ABOVE 40'. FROM 15' TO 18', WEATHERED SUB-VERTICAL FOLIATION JOINTS, SLIGHTLY OXIDIZED, ROUGH, OPEN.
40											
50											
10		R4	40'-50'	98% REC 66% RQD							AT 25.6', A 50-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, OPEN, ALTERATION IN CHLORIDE, CARBONATE COATING. AT 42.1', 45.7', 49.6', 59.9' (OPEN) 60.1', 40 TO 50-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT ALTERATION IN CHLORITE. AT 68.3' A 50-DEGREE FOLIATION JOINT, SMOOTH, OPEN.
60											
20		R5	50'-60'	100 % REC 85% RQD							
70											FROM 72' TO 73', A SUBVERTICAL JOINT ACROSS FOLIATION, TIGHT, ROUGH. FROM 78.75' TO 79.25', A 70-DEGREE SMOOTH FOLIATION JOINT, ALTERATION IN CHLORITE.
30		R6	60'-70'	99% REC 94% RQD							
80											FAIR ROCK FROM 15' TO 26.5' AND
40		R7	70'-80'	100 % REC 88% RQD						80'	

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B18-99
LINE & STA N:322,893.84
OFFSET E:624,742.15

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-26-99
DATE. FINISH: 3-2-99

GROUND ELEVATION 194.72
GROUND WATER ELEVATION 185.86 3/24/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											42' TO 50'. (2-65)
											ROCK QUALITY IMPROVES BELOW 50'. (1-65)
											END OF HOLE 80'
											ORIENTED CORE FROM 20' TO 80'.
											WATER PRESSURE TESTS IN ROCK FROM 20' TO 80'.
											PIEZOMETER INSTALLED AT 12'.
10											
20											
30											
40											

Soil Engineer: _____ Driller: JAKE HARRIS

Drilling Inspector: _____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B19-99
LINE & STA N:323,040.23
OFFSET E:624,760.57

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START: 2-12-99
DATE. FINISH 2-15-99

GROUND ELEVATION 195.57
GROUND WATER ELEVATION 184.17
2/17/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	12"	2	2	2	3		0'-2'	TOPSOIL (3"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
	SS2	2'-4'	14"	2	4	4	5			
	SS3	4'-6'	8"	58	31	29	24			RUSTY BROWN SILTY SAND, TRACE TO SOME GRAVEL, TRACE COBBLES. LOOSE TO VERY DENSE. (SM) (6-65)
	SS4	6'-8'	6"	21	24	27	30		8.5'	
	R1	8.5'-18.5'	57% REC 27% RQD							GNEISS. MEDIUM GRAY, GENERALLY WEATHERED. FOLIATION AT 60 DEGREES TO SUB-VERTICAL. OXIDATION ON JOINTS TO 18.5'. FRACTURED AND OXIDIZED FROM 8.5' TO 13.1'. FROM 12.7' TO 13.1', A 75-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, OXIDIZED. (4-65/3-65)
	R2	18.5'-28'	100 % REC 86% RQD							
	R3	28'-38'	97% REC 78% RQD							

0
10
20
30
40

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B19-99
LINE & STA. N:323,040.23
OFFSET E:624,760.57

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START 2-12-99
DATE. FINISH: 2-15-99

GROUND ELEVATION 195.57
GROUND WATER ELEVATION 184.17 2/17/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											ROCK QUALITY IMPROVES BELOW 18.5'. HARD MODERATELY TO SLIGHTLY WEATHERED. CLOSE TO MODERATELY JOINT SPACING FROM 18.5' TO 48', MODERATELY CLOSE SPACING FROM 48' TO 63.3' AND BELOW 65.5'; CLOSE SPACING FROM 63.3' TO 65.5'.
		R4	38'-48'	95% REC							
50				77% RQD							
10											
		R5	48'-55'	100 % REC							
				86% RQD							
60											
20											
		R6	55'-63.5'	100 % REC							
				97% RQD							
70											
30											
		R7	63.5'-73.5'	98% REC							
				93% RQD							
80											
40											

FROM 21.3' TO 22', A 75-DEGREE FOLIATION JOINT, ROUGH, TIGHT.
FROM 28.5' TO 29', A SUBVERTICAL FOLIATION JOINT; ROUGH, IRREGULAR, BIOTITE.
FROM 31.2' TO 32', A SUBVERTICAL JOINT WITH FOLIATION TREND, ROUGH, TIGHT, CARBONATE COATING.
FROM 46.9' TO 48', A SUBVERTICAL JOINT, ROUGH, IRREGULAR, CHLORITE ALTERATION.
FROM 52' TO 52.6', TWO FOLIATION JOINTS, CURVED, SMOOTH, CHLORITE

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B19-99
LINE & STA. N:323,040.23
OFFSET E:624,760.57

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-12-99
DATE. FINISH: 2-15-99

GROUND ELEVATION 195.57
GROUND WATER ELEVATION 184.17 2/17/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
		R8	73.5'-83.5'	97%	REC					83.5'	ALTERATION. FROM 64' TO 64.5', A SUBVERTICAL FOLIATION JOINT, SMOOTH, CHLORITE ALTERATION, WITH TWO 10 DEGREE JOINTS ACROSS FOLIATION, ROUGH, CHLORITE ALTERATION FAIR ROCK FROM 13.1' TO 18.5' (3-65); GOOD ROCK FROM 18.5' TO 65.5' (2-65); VERY GOOD ROCK BELOW 65.5'. (1-65)
				95%	RQD						
90											
10											
100											END OF HOLE 83.5'
20											
110											
30											
120											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN & SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO MG-B20-99
LINE & STA N:323,238.98
OFFSET E:624,765.45

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START 2-5-99
DATE. FINISH 2-8-99

GROUND ELEVATION 190.94
GROUND WATER ELEVATION 185.23 2/9/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	
		SS1	0'-2'	12"	7	5	5	4		2'	TOPSOIL (3"). DARK GRAY SILTY SAND, ORGANIC MATTER, LOOSE. (SM) (11-65)
		SS2	2'-4'	12"	7	6	5	4			
		SS3	4'-6'	10"	4	4	3	5			RUSTY BROWN SILTY FINE SAND. LOOSE TO 6'. DENSE BELOW 6'.
		SS4	6'-6'8"	5"/2	7	100	/2"			8'	(SM) (7-65)
10											
		R1	8'-18'	83% REC 73% RQD							GNEISS. LIGHT TO MEDIUM GRAY. MODERATELY HARD TO HARD. SOME QUARTZITIC BANDS. MODERATELY WEATHERED TO 14', SLIGHTLY WEATHERED TO UNWEATHERED ON THE REST OF THE CORE. OXIDATION ON JOINTS TO 16.5'. FOLIATION AT 40 DEGREES TO SUB-VERTICAL; GENERALLY AT 60 DEGREES.
20											
		R2	18'-28'	94% REC 88% RQD							
30											
		R3	28'-38'	99% REC 95% RQD							
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN & SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO MG-B20-99
LINE & STA N:323,238.98
OFFSET E:624,765.45

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-5-99
DATE. FINISH: 2-8-99

GROUND ELEVATION 190.94
GROUND WATER ELEVATION 185.23 2/9/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											CLOSE TO MODERATELY CLOSE JOINT SPACING TO 14'. FROM 13' TO 13.8', FRIABLE, OXIDIZED, FRACTURED, A FOLIATION JOINT WITH A SUBHORIZONTAL JOINT. (3-65)
		R4	38'-48'	98% REC							
50				97% RQD							
10											MODERATELY CLOSE JOINT SPACING BELOW 14', MOSTLY SUB-HORIZONTAL JOINTS. IN GENERAL, GOOD ROCK BELOW 14'.
		R5	48'-58'	95% REC							
60				93% RQD							AT 49', A 40-DEGREE JOINT WITH FOLIATION TREND, ROUGH, ALTERED IN EPIDOTE, TIGHT. AT 54.5', A 60-DEGREE FOLIATION JOINT, ROUGH, TIGHT. (1-65)
20											
		R6	58'-68'	98% REC							
70				97% RQD							
30											
		R7	68'-78'	99% REC						78'	
80				98% RQD							END OF HOLE 78'
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B21-99
LINE & STA. N:323,387.65
OFFSET E:624,803.10

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-22-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 190.53
GROUND WATER ELEVATION 185.11 2/26/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	3"	4	3	5	7		0'-2'	TOPSOIL (3"). DARK BROWN GRAY SILTY SAND, ORGANIC MATTER. (SM)(11-65)
	SS2	2'-3'	5"	7	48	100	/0"		3'	RUSTY BROWN SILTY FINE SAND, TRACE GRAVEL. (SM) (7-65)
	R1	3'-13'	99% REC 75% RQD							GNEISS. LIGHT TO MEDIUM GRAY, OXIDIZED ON JOINTS TO 30.5' FOLIATION FROM 60 DEGREES TO SUBVERTICAL. FROM 3' TO 11', 75-DEGREE FOLIATION JOINTS, OXIDIZED. ROCK QUALITY IMPROVES FROM 11'. SOME 60-DEGREE FOLIATION JOINTS AND SUBHORIZONTAL JOINTS FROM 24' TO 39'. IN GENERAL ROCK IS CLOSELY JOINTED FROM 33' TO 35'. A SUBVERTICAL JOINT FROM 41.5' TO 42' AND A SUBHORIZONTAL JOINT AT 41.5' WITH CHLORITIC ALTERATION. (2-65)
	R2	13'-23'	100 % REC 90% RQD							
	R3	23'-33'	100 % REC 81% RQD							

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B21-99
LINE & STA. N:323,387.65
OFFSET E:624,803.10

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE START: 2-22-99
DATE FINISH: 2-24-99

GROUND ELEVATION 190.53
GROUND WATER ELEVATION 185.11 2/26/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R4	33'-43'	99% REC 80% RQD							ROCK BECOMES MODERATELY JOINTED TO MASSIVE FROM 43' TO 63'. (1-65) VERTICAL JOINT FROM 64' TO 66'. MODERATELY CLOSE JOINT SPACING BELOW 66'. (2-65)
50											
10		R5	43'-53'	99% REC 94% RQD							
60											
20		R6	53'-63'	99% REC 96% RQD							
70											
30		R7	63'-72'	99% REC 77% RQD						72'	END OF HOLE 72'
80											
30											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B22-99
LINE & STA N:322,879.17
OFFSET E:624,842.21

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-9-99
DATE. FINISH: 2-10-99

GROUND ELEVATION 193.22
GROUND WATER ELEVATION 179.11 2/11/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	
		SS1	0'-2'	18"	4	3	2	2		2'	TOPSOIL (5"). RUSTY BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	18"	2	2	3	4			
		SS3	4'-6'	18"	3	4	4	5			RUSTY BROWN SILTY FINE TO MEDIUM SAND, TRACE OF
		SS4	6'-8'	18"	5	7	7	8		8'	GRAVEL FROM 5' TO 8'. LOOSE TO MEDIUM DENSE. (SM) (7-65)
		SS5	8'-9'	12"	14	100	/6"				
10		SS6	10'-10.4'	5"	100	/5"					BELOW 8', GREENISH GRAY SILTY SAND, SOME TO LITTLE GRAVEL, COBBLES. DENSE. TILL
		SS7	15'-15.2'	3"	100	/3"				17'	MATERIAL. (SM AND GM) (6-65)
20		SS8	20'-22'	10"	25	38	40	40			TAN BROWN SILTY F-C SAND WITH ROCK FRAGMENTS (GNEISS), MICA, COBBLES, PROBABLE BOULDERS. VERY DENSE.
		SS9	25'-26.2'	12"	57	61	100	/3"			POSSIBLE SAPROLITIC SOIL (DECOMPOSED
										28'	ROCK). (SM AND GM) (6-65/5-65)
30											
		R1	28'-33'	90%	REC						GNEISS. OXIDATION ON JOINTS TO 39.5' AND 55'. OXIDIZED, FRACTURED, SOFT TO MODERATELY HARD, FRIABLE FROM 28' TO 31', WITH FOLIATION AT 40 DEGREES. (4-65/3-65)
				33%	RQD						
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B22-99
LINE & STA N:322,879.17
OFFSET E:624,842.21

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START: 2-9-99
DATE. FINISH 2-10-99

GROUND ELEVATION 193.22
GROUND WATER ELEVATION 179.11 2/10/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
		R2	33'-43'	80% REC							GNEISS BECOMES MEDIUM GRAY, SLIGHTLY WEATHERED AND MODERATELY HARD FROM 31' TO 39.5'. WITH FOLIATION SUB-HORIZONTAL TO 45 DEGREES. (3-65)
				72% RQD							
50											
10											
		R3	43'-53'	98% REC							ROUGH JOINTS TO 39.5', MAINLY SUB-HORIZONTAL JOINTS ACROSS FOLIATION. AT 38.8', A 70-DEGREE FOLIATION JOINT, ROUGH, TIGHT, OXIDIZED.
				88% RQD							
60											
20											
		R4	53'-63'	95% REC							GOOD ROCK BELOW 39.5'. MODERATELY HARD TO HARD, WITH FOLIATION SUB-HORIZONTAL (PREDOMINANT) TO SUBVERTICAL. MODERATELY CLOSE JOINT SPACING FROM 39.5' TO 48' AND BELOW 58'; CLOSE SPACING FROM 48' TO 58'. FROM 49.5' TO 51', A SUBVERTICAL JOINT, SMOOTH, MICA, TIGHT WITH TWO 20-DEGREE JOINTS ACROSS FOLIATION, TIGHT, ROUGH.
				91% RQD							
70											
30											
		R5	63'-73'	98% REC							
				90% RQD							
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B22-99
LINE & STA. N:322,879.17
OFFSET E:624,842.21

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE, START 2-9-99
DATE, FINISH 2-10-99

GROUND ELEVATION 193.22
GROUND WATER ELEVATION 179.11 2/10/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
		R6	73'-83'	97% REC 91% RQD						83'	FROM 54.5' TO 55.5', TWO 60-DEGREE JOINTS ACROSS FOLIATION, OXIDIZED, SMOOTH, TIGHT, WITH TWO 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH. TIGHT. AT 75', 76.7' AND 77.5', 75-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT, MICA. (1-65)
90											
10											END OF HOLE 83'
100											
20											
110											
30											
120											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO MG-B23-99
LINE & STA. N:323,124.25
OFFSET E:624,872.68

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 3-3-99
DATE. FINISH: 3-4-99

GROUND ELEVATION 192.34
GROUND WATER ELEVATION 180.88 3/24/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
									0'-	TOPSOIL 4". DARK BROWN SANDY SILT, SOFT TO MEDIUM
-	SS1	0'-2'	6"	1	1	2	2			
	SS2	2'-4'	9"	3	3	4	5		4'	STIFF, SLIGHTLY PLASTIC, ORGANIC MATTER. (ML) (11-65)
	SS3	4'-6'	8"	3	4	4	4			
	SS4	6'-7'	3"	45	100	100	/0"			RUSTY BROWN SILTY F-M SAND, TRACE GRAVEL. MICA, ROCK FRAGMENTS, COBBLES AND BOULDERS PRESENT BELOW 6' WHERE MATERIAL IS
	SS5	8'-8.5'	1"	100	/6"					
									14'	GENERALLY VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
	R1	14'-15'	75%	REC						
			50%	RQD						
	R2	14'-25'	100	%	REC					GNEISS. LIGHT TO MEDIUM GRAY, GENERALLY AMPHIL-BOLITIC WITH IN-TERMITTENT QUARTZITIC BANDS. QUARTZITIC FROM 37' TO 39'. FAINTLY WEATHERED TO UNWEATHERED. FOLIATION AT 50 TO 75 DEGREES, MOSTLY AT 60 DE-GREES. OXIDATION ON JOINTS TO 15' AND FROM 38.5' TO 39.25'. MODERATELY CLOSE JOINT SPACING.
			81%	RQD						
	R3	25'-35'	100	%	REC					
			90%	RQD						

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B23-99
LINE & STA. N:323,124.25
OFFSET E:624,872.68

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 3-3-99
DATE. FINISH: 3-4-99

GROUND ELEVATION 192.34
GROUND WATER ELEVATION 180.88 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
		R4	35'-45'	100 %	REC						
				90%	RQD						
50											
10											
		R5	45'-55'	100 %	REC						
				91%	RQD						
60											
20											
		R6	55'-65'	98%	REC						
				89%							
70											
30											
		R7	65'-75'	100 %	REC						
				93%	RQD						
80		R8	75'-80'	100 %	REC					80'	
40				76%	RQD						

FROM 14.7' TO 15', A FOLIATION JOINT AT 60 DEGREES, ROUGH, OXIDIZED, OPEN. FROM 18.5' TO 29.5' A FOLIATION JOINT AT 75 DEGREES, ROUGH, TIGHT.

FROM 34' TO 35', ROCK IS JOINTED ALONG FOLIATION WITH FOUR JOINTS AT 70 DEGREES, ROUGH, TIGHT.

FROM 56.5' TO 56.8', A FOLIATION JOINT AT 60 DEGREES, ROUGH, TIGHT, MODERATELY ALTERED IN CHLORITE, WITH A 5-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. CLOSE JOINT SPACING.

FROM 65' TO 66.5' AND 77.5' TO 78.4', A 70-DEGREE FOLIATION JOINT, SMOOTH, OPEN, SOFT, ALTERED IN CHLORITE, WITH TWO 5-DEGREE JOINTS ACROSS FOLIATION, ROUGH.

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B23-99
LINE & STA N:323,124.25
OFFSET E:624,872.68

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 3-3-99
DATE. FINISH: 3-4-99

GROUND ELEVATION 192.34
GROUND WATER ELEVATION 180.88 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											IN GENERAL, THE ROCK QUALITY IS GOOD. (2-65)
											END OF HOLE 80'
											WATER PRESSURE TESTS IN ROCK FROM 14' TO 74'.
10											PIEZOMETER INSTALLED AT 68.5'.
20											
30											
40											

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B24-99
LINE & STA N:323,401.34
OFFSET E:624,904.28

DEPTH _____ FT. ____ FT. CASING OUT DATE _____
DEPTH _____ FT. ALL CASING OUT DATE _____

DATE. START: 2-23-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 185.74
GROUND WATER ELEVATION 179.13 2/26/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	11"	1	2	2	3		0'-2'	TOPSOIL (3). DARK GRAY SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	14"	4	6	5	7			
		SS3	4'-6'	16"	14	17	18	21			RUSTY BROWN SILTY FINE SAND, SOME GRAVEL FROM 6' TO 10'. MEDIUM DENSE TO VERY DENSE. (SM) (6-65)
		SS4	6'-8'	12"	29	37	40	100			
		SS5	8'-8.1'	1"	100	/2"		/4"		11'	
10											GNEISS. MEDIUM GRAY, HARD. OXIDATION ON JOINTS FROM 11' TO 19' AND FROM 36' TO 41.5'. FOLIATION AT 60 DEGREES TO SUB-VERTICAL TO INDISTINCT. ROCK SLIGHTLY SCHISTOSE BELOW 32'.
20		R1	11'-21'	77% REC 65% RQD							SUBVERTICAL JOINT ACROSS FOLIATION FROM 24' TO 26' ALTERED IN EPIDOTE AND CHLORITE WITH A 20-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT, EPIDOTE. GENERALLY GOOD ROCK FROM 26' TO 36'. (3-65/2-65)
30		R2	21'-31'	98% REC 78% RQD							
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B24-99
LINE & STA. N:323,401.34
OFFSET E:624,904.28

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE. _____

DATE. START: 2-23-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 185.74
GROUND WATER ELEVATION 179.13 2/26/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		R3	31'-41'	98%	REC						FROM 36' TO 41.5', A SUBVERTICAL JOINT, OXIDIZED, ALTERED IN CHLORITE AND EPIDOTE, WITH NINE 10-DEGREE JOINTS ACROSS FOLIATION. (3-65)
40				47%	RQD						
50											
10		R4	41'-51'	99%	REC						JOINTS BELOW 51' ARE SMOOTH, TIGHT, AT 30 TO 40 DEGREES. GOOD ROCK FROM 41.5' TO 65', WITH MODERATELY CLOSE JOINT SPACING. (1-65)
				98%	RQD						
60											
20		R5	51'-61'	100	%	REC					
				94%	RQD						
		R6	61'-65'	100	%	REC				65'	
				96%	RQD						END OF HOLE 65'
70											
30											
80											
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO MG-B25-99
LINE & STA N:323,596.59
OFFSET E: 624,955.96

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE, START: 2-24-99
DATE, FINISH: 2-25-99

GROUND ELEVATION 181.35
GROUND WATER ELEVATION 177.13 2/26/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	RUSTY BROWN SILTY F-M SAND, TRACE TO SOME GRAVEL. MEDIUM DENSE TO VERY DENSE. (SM, SP-SM) (6-65)
		SS1	0'-2'	24"	25	17	11	10			
		SS2	2'-4'	12"	18	25	26	25			
		SS3	4'-5.2'	10"	20	55	100	/3"		6'	
		SS4	6'-8'	12"	46	36	30	33			YELLOW BROWN SILTY F-M SAND, SOME GRAVEL, MICA, ROCK FRAGMENTS (GNEISS). VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
10		SS5	8'-10'	18"	37	36	76	50			
		SS6	10.1'-10.7'	4"	49	100	/3"			11.6'	
		R1	11.6'-16.6'	47%	REC						GNEISS. MEDIUM GRAY. WEATHERED AND FRACTURED FROM 11.6' TO 23'. FOLIATION AT 60 DEGREES TO SUBVERT-ICAL. OXIDATION ON JOINTS TO 23'. A SUBVERTICAL FOLIA-TION JOINT FROM 20' TO 23', OXIDIZED, SOFT, FRIABLE, OPEN, IN COMBINATION WITH SIX SUBHORIZONTAL JOINTS, OXIDIZED, ROUGH, OPEN. (3-65)
				17%	RQD						
20		R2	16.6'-21.6'	80%	REC						
				30%	RQD						
		R3	21.6'-26.6'	85%	REC						
				43%	RQD						
30		R4	26.6'-31.6'	100	%	REC					
				95%	RQD						
		R5	31.6'-35'	96%	REC						
				81%	RQD					35'	ROCK QUALITY IM-PROVES BELOW 23' WITH MODERATELY CLOSE JOINT SPACING.
40											

Soil Engineer: ____ Driller: GREG MARNEY JR.

Drilling Inspector: ____ Helper: THEO RODRIGUEZ

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B25-99
LINE & STA. N:323,596.59
OFFSET E: 624,955.96

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START 2-24-99
DATE. FINISH: 2-25-99

GROUND ELEVATION 181.35
GROUND WATER ELEVATION 177.13
2/26/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											BELOW 26.5', CHLORITE ALTERATION ON JOINTS ACROSS FOLIATION AT 10 TO 25 DEGREES. (2-65)
											END OF HOLE 35'
10											
20											
30											
40											

Soil Engineer: ____ Driller: GREG MARNEY JR.

Drilling Inspector: ____ Helper: THEO RODRIGUEZ

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B26-99
LINE & STA. N:322,869.32
OFFSET E:624,941.05

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-5-99
DATE. FINISH: 2-8-99

GROUND ELEVATION 191.48
GROUND WATER ELEVATION 175.48 2/5/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	
		SS1	0'-2'	10"	5	3	2	2		2'	TOPSOIL (3"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS3	2'-4'	14"	4	6	6	9			
		SS3	4'-6'	3"	28	100	/1"				TAN BROWN SILTY FINE SAND, TRACE GRAVEL TO 4', SOME GRAVEL TO 8', SOME BOULDERS (8' TO 10' AND 13' TO 23'). GENERALLY DENSE. (SM AND GM) (6-65)
		SS4	6'-8'	3"	19	22	27	31			
10		R1	8'-10'	58"	REC	BOU	LDE	RS			
		SS5	10'-10.2'	NR							
		SS6	12'-12.6'	5"	34	100	/1"				
20											
		R2	13'-23'	32%	REC	BOU	LDE	RS			
		SS7	23'-23.4'	3"	100	/5"					
30											
		R3	23.5'-33.5'	NR							
		SS8	33.5'-33.4'	3"	100	/5"				33'	
											RUSTY BROWN SILTY F-M SAND WITH ROCK FRAGMENTS (GNEISS), MICA, COBBLES. GENERALLY VERY DENSE.
40		R4	33.5'-40'	NR							

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO MG-B26-99
LINE & STA N:322,869.32
OFFSET E:624,941.05

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 2-5-99
DATE. FINISH: 2-8-99

GROUND ELEVATION 191.48
GROUND WATER ELEVATION 175.48 2/5/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS3	40'-40.5'	3"	100	/6"				40.5'	POSSIBLE SAPROLITIC SOIL(DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
40		R5	40.5'-45.5'	70% REC 60% RQD							GNEISS. AMPHIBOLITIC, WEATHERED AND FRACTURED FROM 40.5' TO 42'.
50 10		R6	45.5'-55.5'	96% REC 92% RQD							ROCK QUALITY IMPROVES AT 42'.HARD, SLIGHTLY WEATHERED TO UNWEATHERED, MEDIUM GRAY GNEISS BELOW 42'. FOLIATION AT 20 TO 40 DEGREES. MODERATELY CLOSE JOINT SPACING. A FEW SUBHORIZONTAL JOINTS ACROSS FOLIATION. GENERALLY GOOD GOCK. (1-65)
60 20		R7	55.5'-65.5'	99% REC 95% RQD							AT 57.4', A SMOOTH JOINT WITH FOLIATION TREND AT 30 DEGREES. AT 58.6', A SMOOTH FOLIATION JOINT AT 30 DEGREES, MICA.
70 30		R8	65.5'-75.5'	99% REC 96% RQD						75.5'	END OF HOLE 75.5'
80 40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 4
LOCATION BRONX, NY
HOLE NO MG-B27-99
LINE & STA N:323,015.09
OFFSET E:624,959.81

DEPTH ____ FT ____ FT CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE START 2-3-99
DATE FINISH 2-4-99

GROUND ELEVATION 192.16
GROUND WATER ELEVATION 185.47 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	TOPSOIL(2"). RUSTY
		SS1	0'-2'	14"	3	3	2	3		2'	BROWN SILTY FINE SAND, ORGANIC MATTER, TRACE GRAVEL. LOOSE. (SM) (11-65)
		SS2	2'-4'	12"	2	4	4	5			
		SS3	4'-6'	6"	4	5	20	25			
		SS4	6'-8'	6"	25	30	31	32			RUSTY BROWN SILTY FINE SAND, TRACE TO SOME GRAVEL. LOOSE
		SS5	8'	NR	100	/0"				10'	TO 4', FROM 4' TO 12' DENSE TO VERY DENSE. (SM) (6-65)
10											
		R1	8'-13'	45%	REC	BOU	LDE	RS			GREENISH GRAY SILTY F-C SAND, SOME TO LITTLE GRAVEL, COBBLES AND BOULDERS. BOULDERS CORED FROM 8' TO 13'. VERY DENSE. TILL MATERIAL. (SM AND GM) (6-65/5-65)
		SS6	14'-16'	8"	24	52	36	43			
		SS7	16'-18'	10"	27	28	34	44			
		SS8	18'	NR	100	/0"	BOU	LDE	RS		
20										22'	
		SS9	20'-22'	8"2	6	35	38	41			
	SS	10	22'-24'	10"	39	43	55	77			YELLOW BROWN SILTY F-M SAND WITH ROCK
	SS	11	24'-26'	12"	67	79	85	91		26'	FRAGMENTS (GNEISS), MICA. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK) (SP-SM AND GP-GM) (6-65/5-65)
30											
		R2	26'-32'	85%	REC						GNEISS. MEDIUM GRAY
				22%	RQD						FROM 26' TO 37', SOFT TO MODERATELY HARD, WEATHERED, OXIDIZED, FRACTURED. FOLIATION FROM SUB-HORIZONTAL TO 60 DEGREES. CLOSE
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 4
LOCATION BRONX, NY
HOLE NO MG-B27-99
LINE & STA N:323,015.09
OFFSET E:624,959.81

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START: 2-3-99
DATE. FINISH: 2-4-99

GROUND ELEVATION 192.16
GROUND WATER ELEVATION 185.47 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R3	32'-42'	90% REC 48% RQD							JOINT SPACING. (4-65/3-65) ROCK QUALITY IMPROVES AT 37'. FROM 37' TO 42' ROCK IS MODERATELY WEATHERED, SOFT, CLOSELY JOINTED. FROM 36.5' TO 37', A SUBVERTICAL FOLIATION JOINT, SMOOTH, CHLORITE, OPEN, SOFT, FRIABLE WTIH THREE 5 TO 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, CARBONATE COATING. FROM 39.5'TO 40.8', A 80-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, WITH TWO JOINTS WITH FOLIATION TREND, ROUGH, OPEN.(3-65)
10		R4	42'-52'	98% REC 75% RQD							
60											
20		R5	52'-62'	98% REC 85% RQD							
70											FROM 42' TO 53.2', MODERATELY CLOSE JOINT SPACING, SLIGHTLY WEATHERED TO UNWEATHERED. FOLIATION AT 30 TO 80 DEGREES.
30		R6	62'-72'	98% REC 90% RQD							
		R7	72'-77'	98% REC 91% RQD						77'	FROM 42' TO 43.2', AN 80-DEGREE FOLIATION JOINT, SMOOTH, OPEN, MICA.
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 4
LOCATION BRONX, NY
HOLE NO MG-B27-99
LINE & STA N:323,015.09
OFFSET E:624,959.81

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-3-99
DATE. FINISH: 2-4-99

GROUND ELEVATION 192.16
GROUND WATER ELEVATION 185.47 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											WITH THREE 10-DEGREE JOINTS(ONE WITH FOLIATION TREND AND TWO ACROSS FOLIATION). OPEN, ROUGH. FROM 47.7' TO 49', A 60-DEGREE FOLIATION JOINT, SMOOTH, OPEN, MICA, CHLORITE, SOFT, WITH A 10-DEGREE JOINT ACROSS FOLIATION ROUGH, OPEN. AT 51', A 60-DEGREE FOLIATION JOINT, SMOOTH, OPEN WITH A 20-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. FROM 52' TO 53.2', FRACTURED WITH TWO FOLIATION JOINTS, SMOOTH, OPEN, AN 80-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT AND TWO 10-DEGREE JOINTS WITH FOLIATION TREND, ROUGH, OPEN.(2-65) BELOW 53.2', HARD, UNWEATHERED ROCK. FOLIATION AT 40 TO 60 DEGREES. MODERATELY CLOSE TO WIDE JOINT SPACING.
10											
20											
30											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 4 OF 4
LOCATION BRONX, NY
HOLE NO MG-B27-99
LINE & STA N:323,015.09
OFFSET E:624,959.81

DEPTH ____ FT ____ FT. CASING OUT DATE. ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START: 2-3-99
DATE. FINISH: 2-4-99

GROUND ELEVATION 192.16
GROUND WATER ELEVATION 185.47 2/5/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											AT 72' AND 73', 80 AND 70-DEGREE FOLIATION JOINTS RESPECTIVELY, SMOOTH, TIGHT, MICA. AT 73.8', A 60-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. AT 74.1', A 50-DEGREE FOLIATION JOINT, SMOOTH, MICA FROM 74.1' TO 74.6', AN 80-DEGREE JOINT WITH FOLIATION TREND, SMOOTH, TIGHT, IRREGULAR, MICA. AT 74.6' A 20-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. IN GENERAL GOOD ROCK, (1-65)
10											
20											
30											END OF HOLE 77'
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VANCORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO MG-B28-99
LINE & STA N:323,214.78
OFFSET E:624,983.06

DEPTH ____ FT. ____ FT CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE START 2-3-99
DATE FINISH 2-4-99

GROUND ELEVATION 188.28
GROUND WATER ELEVATION 175.74 2/9/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV - FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	TOPSOIL(4"). DARK
		SS1	0'-2'	12"	2	4	3	4		2'	GRAY SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	14"	5	7	8	10			
		SS3	4'-6'	12"	8	11	16	21			BROWN SILTY FINE TO MEDIUM SAND, TRACE TO SOME GRAVEL, GRAVEL CONTENT TENDS TO INCREASE BELOW 5'. MEDIUM DENSE TO DENSE FROM 2' TO 11'. VERY
		SS4	6'-8'	12"	32	16	14	17			
10		SS5	8'-10'	11"	12	17	20	23			
		SS6	10'-12'	8"	20	24	29	31			
		SS7	12'-14'	10"	27	29	32	38		14'	DENSE BELOW 11'. (SM, SP-GM) (6-65)
		SS8	14'-16'	10"	30	37	49	100			YELLOW BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS (GNEISS), COBBLES, PROBABLE BOULDERS.
								/5"			
		SS9	16'-18'	3"	100	/5"					
20	SS	10	18'-20'	2"	100	/4"					
	SS	11	20'-21'	2"	100	/3"				21'	VERY DENSE. POSSIBLE SAPROLITIC SOIL. (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
		R1	21'-26'	75%	REC						GNEISS. LIGHT GRAY, SCHISTOSE, MODERATELY HARD TO HARD, SLIGHTLY WEATHERED TO UNWEATHERED. OXIDATION ON JOINTS TO 30'.
				66%	RQD						
30											FOLIATION AT 10 TO 30 DEGREES FROM 21' TO 33'; AT 30 TO 50 DEGREES FROM 33' TO 56'; 50 TO 70 DEGREES
		R2	26'-36'	98%	REC						
				62%	RQD						
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VANCORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO MG-B28-99
LINE & STA. N:323,214.78
OFFSET E:624,983.06

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START. 2-3-99
DATE. FINISH: 2-4-99

GROUND ELEVATION 188.28
GROUND WATER ELEVATION 175.74
2/9/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											BELOW 56'.
											CLOSE JOINT SPACING FROM 21' TO 30'. 10 TO 30-DEGREE FOLIATION JOINTS PREDOMINATE, AT 21', 22.8', SMOOTH FOLIATION JOINTS, TIGHT, MICA. (3-65)
		R3 36'-46'		99% REC 93% RQD							
50											
10											
											BELOW 30', MODERATELY CLOSE JOINT SPACING. AT 33' AND 34', SMOOTH FOLIATION JOINTS, TIGHT, MICA. FROM 46.5' TO 46.8', A 60-DEGREE JOINT ACROSS FOLIATION, IRREGULAR, TIGHT, CHLORITE.
		R4 46'-56'		99% REC 86% RQD							
60											
20											
											FROM 55.6' TO 56', TWO 60-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT, MICA. FROM 56' TO 56.7', FRACTURED ROCK, CHLORITE ALTERATION, SOFT, WITH FIVE SUB-HORIZONTAL JOINTS, OPEN. POSSIBLE SHEARING. MODERATELY JOINTED BELOW 57'. ROCK IS GENERALLY GOOD. (1-65/2-65)
		R5 56'-66'		98% REC 86% RQD						66'	
70											
30											
80											
40											END OF HOLE 66'

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B29-99
LINE & STA. N:323,392.71
OFFSET E:625,005.14

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE START: 3-9-99
DATE FINISH: 3-11-99

GROUND ELEVATION 181.72
GROUND WATER ELEVATION 177.85 3/24/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	9"	1	2	2	2		0'-	TOPSOIL(3"). DARK BROWN AND LIGHT BROWN SILTY FINE SAND. LOOSE TO MEDIUM DENSE. (SM) (7-65)
		SS2	2'-4'	13"	3	5	7	7		4'	
10		R1	4'-10'	30% REC 0% RQD	BOU	LDE	RS			10'	SILTY SAND WITH COBBLES AND BOULDERS. (GM AND SM) (6-65)
		R2	10'-15'	95% REC 88% RQD							GNEISS. MEDIUM GRAY, HARD, SCHISTOSE FROM 25' TO 27.5', 42' TO 45'. FAINTLY WEATHERED TO UN-WEATHERED. FOLIATION AT 40 TO 50 DEGREES. FOLIATION AT 70 DEGREES TO SUB-VERTICAL FROM 15' TO 17.5', 29.4' TO 31.2'. INDISTINCT FROM 31.2' TO 35'. OXIDATION ON JOINTS TO 32', CLOSE TO MODERATELY CLOSE JOINT SPACING. VERY CLOSE SPACING FROM 31' TO 34'.
20		R3	15'-25'	96% REC 73% RQD							GOOD ROCK FROM 35' TO 40' AND BELOW 45'.
30		R3	25'-35'	97% REC 48% RQD							FROM 15.5' TO 16.8', A SUBVERTICAL FOLIATION JOINT.
40											

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B29-99
LINE & STA. N:323,392.71
OFFSET E:625,005.14

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE, START: 3-9-99
DATE, FINISH: 3-11-99

GROUND ELEVATION 181.72
GROUND WATER ELEVATION 177.85 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV - FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											IRREGULAR, OXIDIZED TIGHT, ROUGH, AT 17.7' AND 18.9', TWO 60-DEGREE JOINTS ACROSS FOLIATION, OXIDIZED, ROUGH, OPEN.
		R5	35'-45'	98% REC							
				80% RQD							
50											
10											FROM 30.7' TO 31.9', A SUBVERTICAL JOINT, CURVED, IRREGULAR, OXIDIZED, ROUGH, OPEN, CARBONATE COATING WITH A 10-DEGREE JOINT ACROSS FOLIATION, OPEN.
		R6	45'-55'	98% REC							
				80% RQD							
60											FROM 31.9' TO 33.3', FRACTURED ZONE ALONG FOLIATION, SOFT AND FRIABLE, WITH CHLORITIC ALTERATION, CARBONATE COATING. POSSIBLE SHEAR ZONE.
20											
		R7	55'-65'	98% REC						65'	
				98% RQD							
70											AT 42', A 50-DEGREE JOINT ACROSS FOLIATION, SMOOTH, TIGHT. FROM 42.4' TO 45', SEVEN FOLIATION JOINTS AT 40 DEGREES, SMOOTH, AND ONE SUB-HORIZONTAL JOINTS, ROUGH, TIGHT.
30											
40											

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B29-99
LINE & STA. N:323,392.71
OFFSET E:625,005.14

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 3-9-99
DATE. FINISH: 3-11-99

GROUND ELEVATION 181.72
GROUND WATER ELEVATION 177.85 3/24/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											FROM 47.4' TO 47.15', TWO 60-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT. FROM 50' TO 50.5', A 70-DEGREE JOINT, SMOOTH, ALTERATION IN EPIDOTE. FROM 50.75' TO 51.3' THREE FOLIATION JOINTS, ROUGH, TIGHT, ALTERATION IN EPIDOTE. (2-65)
10											
20											END OF HOLE 65' ORIENTED CORE FROM 45' TO 65'. WATER PRESSURE TESTS IN ROCK FROM 15' TO 65'. PIEZOMETER INSTALLED AT 55'.
30											
40											

Soil Engineer: _____ Driller: JAKE HARRIS

Drilling Inspector: _____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B30-99
LINE & STA. N:322,855.71
OFFSET E:625,040.79

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALT CASING OUT DATE: ____

DATE. START: 2-17-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 193.87
GROUND WATER ELEVATION 176.32 3/24/99

CASING O.D. HW ____ I.D. ____
SAMPLER O.D. 2" ____ I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	16"	3	3	2	2		0'-2'	TOPSOIL(2"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	20"	6	5	5	7			
		SS3	4'-6'	6"	10	20	22	19			RUSTY BROWN SILTY F-M SAND, TRACE TO SOME GRAVEL. MEDIUM DENSE TO DENSE. (SM, SP-SM) (6-65)
		SS4	6'-8'	8"	23	24	26	21			
10		SS5	8'-10'	8"	10	13	14	16			
										16'	
		SS6	16'3"-18'3"	5"	24	26	31	45			BROWN GRAY SILTY SAND, TRACE TO SOME GRAVEL, COBBLES. BOULDERS. VERY DENSE. POSSIBLE TILL MATERIAL. (SM AND GM) (6-65/5-65)
20		R1	18'3"-20'	8%	REC	BOU	LDE	RS			
30		R2	20'-30.5'			BOU	LDE	RS		30.5'	
		R3	30.5'-35'	94%	REC						GNEISS. LIGHT GRAY. HARD. QUARTZITIC FROM 31' TO 33'; 47' TO 48'; 67' TO 71.5'. FAINTLY WEATHERED TO UN-WEATHERED. FOLIATION MOSTLY SUBVERTICAL; AT 60 DEGREES FROM 46' TO 49'.
				72%	RQD						
		R4	35'-40'	97%	REC						
40				30%	RQD						

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO MG-B30-99
LINE & STA N:322,855.71
OFFSET E:625,040.79

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE, START: 2-17-99
DATE, FINISH: 2-24-99

GROUND ELEVATION 193.87
GROUND WATER ELEVATION 176.32 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											OXIDATION ON JOINTS TO 41'. FROM 30.5' TO 35', JOINTS ACROSS FOLIATION PREDOMINATE. FROM 35' TO 40', 30-DEGREE JOINTS WITH FOLIATION TREND PRODOMINATE. VERY CLOSE TO CLOSE JOINT SPACING. FRACTURED FROM 38.3' TO 40', SMOOTH JOINTS. (3-65)
		R5	40'-45.5'	100 % REC 82% RQD							
10		R6	45.5'-49.5'	100 % REC 46% RQD							
60											GENERALLY GOOD ROCK BELOW 40' WITH CLOSE TO MODERATELY CLOSE JOINT SPACING, EXCEPT FROM 45' TO 49' WHERE THE ROCK IS VERY CLOSELY JOINTED. A SUB-VERTICAL FOLIATION JOINT FROM 47' TO 49.5', ROUGH, PITTED CORE SURFACE. FROM 53.7' TO 54.2', A 70-DEGREE FOLIATION JOINT, SMOOTH. BELOW 69', ONLY A FEW SUBHORIZONTAL JOINTS, ROUGH, TIGHT. (1-65)
20		R7	49.5'-59.5'	100 % REC 84% RQD							
70		R8	59.5'-69'	100 % REC 99% RQD							
30											
		R9	69'-75'	99% REC 97% RQD						75'	
80											END OF HOLE 75'
40											

Soil Engineer: ____ Driller: JAKE HARRIS

Drilling Inspector: ____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B30-99
LINE & STA. N:322,855.71
OFFSET E:625,040.79

DEPTH _____ FT ____ FT CASING OUT DATE: _____
DEPTH _____ FT ALL CASING OUT DATE. _____

DATE. START: 2-17-99
DATE. FINISH: 2-24-99

GROUND ELEVATION 193.87
GROUND WATER ELEVATION 176.32 3/24/99

CASING O.D HW I.D _____
SAMPLER O.D. 2" I.D _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0 - 6	6 - 12	12 - 18	18 - 24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
		0								ORIENTED CORE FROM 30' TO 75'.
										WATER PRESSURE TESTS IN ROCK FROM 30' TO 75'.
		10								TWO PIEZOMETERS INSTALLED AT 32' AND 70'.
		20								
		30								
		40								

Soil Engineer: _____ Driller: JAKE HARRIS

Drilling Inspector: _____ Helper: DAVE HARRIS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B31-99
LINE & STA N:323,103,27
OFFSET E:625,070.95

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-1-99
DATE. FINISH: 2-2-99

GROUND ELEVATION 188.34
GROUND WATER ELEVATION 172.93 2/5/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	12"	7	5	5	4		0'-2'	TOPSOIL(4"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	10"	12	10	9	6			
		SS3	4'-6'	12"	13	11	6	11		6'	RUSTY BROWN SILTY FINE SAND, TRACE GRAVEL. MEDIUM DENSE. (SM) (7-65)
		SS4	6'-8'	14"	22	20	20	23			
10		SS5	8'-10'	12"	24	21	30	47			GREENISH GRAY SILTY SAND, SOME TO LITTLE GRAVEL, COBBLES. DENSE TO VERY DENSE. TILL MATERIAL. (SP-SM AND GP-GM) (6-65)
		SS6	10'-10.5'	2"	100	/2"	WAS	H			
20		R1	10.5'-20.5'	28%	REC					20.5'	
		R2	20.5'-30.5'	98%	REC						GNEISS. MEDIUM GRAY, HARD, MODERATELY WEATHERED, OXIDIZED ON JOINTS TO 61.5'. FOLIATION AT 30 TO 60 DEGREES TO 31'; 60 TO 70 DEGREES FROM 31' TO 55'; INDISTINCT BELOW 55'.
30				71%	RQD						
		R3	30.5'-40.5'	98%	REC						CLOSE TO MODERATELY CLOSE JOINT SPACING FROM 20.5' TO 40.5'. SUBHORIZONTAL JOINTS PREDOMINATE. FRACTURED FROM 20.5' TO 22.5'. A
40				80%	RQD						

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B31-99
LINE & STA. N:323,103,27
OFFSET E:625,070.95

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-1-99
DATE. FINISH: 2-2-99

GROUND ELEVATION 188.34
GROUND WATER ELEVATION 172.93 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											VERTICAL JOINT FROM 37.7' TO 40.5', OXIDIZED, ROUGH, WITH SIX 5-DEGREE JOINTS, OXIDIZED, ROUGH, TIGHT. (2-65)
40											
50											
10		R4	40.5'-50.5'	99% REC 91% RQD							QUARTZITIC GNEISS FROM 40.5' TO 43' AND FROM 51' TO 59.5'.
60											BELOW 40.5', HARD, WEATHERED, MODERATELY CLOSE JOINT SPACING. SUB-HORIZONTAL JOINTS PREDOMINATE BELOW 50.5'.
20		R6	50.5'-60.5'	99% REC 84% RQD							FROM 43.2'TO 43.7', AND 44.2' TO 44.7', TWO 60-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OXIDIZED, TIGHT. FROM 58.7'TO 59.7', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT, COATED WITH CARBONATE, WITH THREE SUBHORIZONTAL JOINTS, OXIDIZED, ROUGH. GENERALLY GOOD ROCK BELOW 40.5'. (1-65)
70											
30		R6	60.5'-70.5'	98% REC 90% RQD							
		R7	70.5'-75.5'	96% REC 93% RQD						75.5'	
80											END OF HOLE 75.5'
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B32-99
LINE & STA. N:323,378.75
OFFSET E:625,106.97

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 3-3-99
DATE. FINISH: 3-4-99

GROUND ELEVATION 180.87
GROUND WATER ELEVATION 176.33 3/5/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
		SS1	0'-2'	18"	4	3	2	2		0'-2'	DARK BROWN SILTY SAND, SOME GRAVEL, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-4'	14"	2	4	6	7			
		SS3	4'-6'	15"	5	7	7	9			BROWN SILTY FINE SAND WITH SAND SILT INTERLAYERS. POSSIBLE COBBLES FROM 8' TO 10'. MEDIUM DENSE TO VERY DENSE. (SM) (6-65)
		SS4	6'-8'	8"	12	16	19	22			
10		SS5	8'-10'	NR	3 2	33	39	20		10'	
		SS6	10'-12'	11"	9	11	12	13			
		SS7	12'-14'	12"	14	19	38	42		15'	RUSTY BROWN SILTY F-M SAND, TRACE GRAVEL, MICA, ROCK FRAGMENTS. DENSE TO VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65)
20											
		R1	15'-25'	100 %	REC						GNEISS. MEDIUM GRAY, HARD. FOLIATION AT 50 TO 60 DEGREES, SUB-VERTICAL FROM 15' TO 22' AND BELOW 45'. FAINTLY WEATHERED. OXIDATION ON JOINTS TO 16.5'. CLOSE TO MODERATELY CLOSE JOINT SPACING FROM 30.5' TO 36'. MODERATELY CLOSE SPACING BELOW 36'.
				100 %	RQD						
30											
		R2	25'-35'	100 %	REC						
				90%	RQD						
40											

Soil Engineer: ____ Driller: ____

Drilling Inspector: ____ Helper: ____

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B32-99
LINE & STA N:323,378.75
OFFSET E:625,106.97

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 3-3-99
DATE. FINISH: 3-4-99

GROUND ELEVATION 180.87
GROUND WATER ELEVATION 176.33 3/5/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
		R3	35'-45'	98%	REC						
				70%	RQD						
50											
10											
		R4	45'-55'	98%	REC						
				98%	RQD						
60											
20		R5	55'-60'	100 %	REC					60'	AT 15.8', A 60-DEGREE FOLIATION JOINT, SLIGHTLY OXIDIZED, SMOOTH, OPEN. AT 16.5', A 70-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, SMOOTH, TIGHT. AT 33' AND 34', TWO 60-DEGREE JOINTS WITH FOLIATION TREND, SMOOTH, OPEN, CHLORITE ALTERATION. FROM 33.5' TO 33.75' SOFT, FRIABLE ZONE, ALTERATION IN EPIDOTE. POSSIBLE SHEAR ZONE. AT 34.2', A 40-DEGREE JOINT ACROSS FOLIATION, SMOOTH, JOINT, OPEN. FROM 36.3' TO 37.75', AN 80-DEGREE JOINT ACROSS FOLIATION, ROUGH, OPEN, ALTERATION CHLORITE. (1-65)
				100 %	RQD						
70											
30											END OF HOLE 60'
80											
40											

Soil Engineer: ____ Driller: ____

Drilling Inspector: ____ Helper: ____

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B33-99
LINE & STA. N:323,679.09
OFFSET E:625,141.00

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-25-99
DATE. FINISH: 2-25-99

GROUND ELEVATION 173.13
GROUND WATER ELEVATION 169.47 2/26/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-0.3'	ASPHALT(4"). FILL MATERIAL. DARK GRAY SILTY SAND, TRACE GRAVEL. DENSE. (SM) (7-65)
		SS1	1'-3'	18"	24	21	14	50		3'	
		SS2	3'-5'	24"	49	10	19	27			
		SS3	5'-7'	24"	1	2	3	5		5'	LIGHT GRAY F-M SAND, TRACE GRAVEL. DENSE. FILL MATERIAL. (SP)(6-65)
		SS4	7'-9'	24"	3	4	7	8			
10		SS5	9'-11'	12"	16	22	8	5			GREENISH GRAY SILTY SAND, TRACE TO SOME GRAVEL TO 9', LITTLE GRAVELLY BELOW 9'. LOOSE TO MEDIUM DENSE. POSSIBLE TILL MATERIAL. (SM AND GM) (6-65)
		SS6	15'-17'	12"	14	13	21	19		15'	
20										20'	DARK BROWN SILTY FINE MEDIUM SAND, MICA, ROCK FRAGMENTS. DENSE. POSSIBLE SAPROLITIC SOIL(DECOMPOSED ROCK). (SM AND GM) (6-65)
		R1	20'-25'	100 % 75%	REC RQD						
30		R2	25'-30'	100 % 83%	REC RQD						GNEISS. MEDIUM GRAY. MODERATELY HARD. FOLIATION AT 50 TO 70 DEGREES. FOLIATION JOINTS PREDOMINATE. MODERATELY CLOSE TO CLOSE JOINT SPACING ON TOP 4 FEET.
40											

Soil Engineer: ____ Driller: ____

Drilling Inspector: ____ Helper: ____

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B33-99
LINE & STA. N:323,679.09
OFFSET E:625,141.00

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START: 2-25-99
DATE. FINISH: 2-25-99

GROUND ELEVATION 173.13
GROUND WATER ELEVATION 169.47 2/26/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
		0								AT 21.75' AND 22', TWO 50-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT. FROM 28.8' TO 29.25', A 70-DEGREE FOLIATION JOINT, ROUGH, TIGHT, SOME CHLORITIC ALTERATION. (2-65)
		10								END OF HOLE 30'
		20								
		30								
		40								

Soil Engineer: ____ Driller: ____

Drilling Inspector: ____ Helper: ____

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B34-99
LINE & STA. N:322,813.48
OFFSET E:625,136.85

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-9-99
DATE. FINISH: 2-10-99

GROUND ELEVATION 187.81
GROUND WATER ELEVATION _____

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER _____ LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											ANGLED BOREHOLE DIRECTION: N 8 DEGREES E ANGLE: 60 DEGREES ROLLER BIT TO TOP OF ROCK
10											
20											NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL
										26'	
30		R1	26.2'-32'	99% REC 82% RQD							GNEISS. MEDIUM GRAY, MODERATELY WEATHERED, MODERATELY HARD TO HARD TO 37'. FOLIATION AT 50 TO 85 DEGREES. OXIDATION ON JOINTS TO 100'. CLOSE TO MODERATELY CLOSE JOINT SPACING TO 40.3'.
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B34-99
LINE & STA. N:322,813.48
OFFSET E:625,136.85

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START: 2-9-99
DATE. FINISH: 2-10-99

GROUND ELEVATION 187.81
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER ____ LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										
40	R2	32'-42'	99% REC 65% RQD							FROM 26.3'TO 26.9', A 70-DEGREE FOLIATION JOINT, ROUGH, OXIDIZED, TIGHT. FROM 37.3'TO 40.3', ROCK IS FRACTURED, FRIABLE ALONG A SUBVERTICAL FOLIATION JOINT, SLIGHTLY OXIDIZED, ROUGH, OPEN, WITH THREE 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OPEN. (2-65)
50 10	R3	42'-52'	98% REC 91% RQD							BELOW 40.3' MODERATELY CLOSE JOINT SPACING, EXCEPT FROM 44' TO 45' AND 56.5' TO 58' WHERE ROCK IS CLOSELY JOINTED.
60 20	R4	52'-62'	94% REC 78% RQD							FROM 49.6' TO 50', A 70-DEGREE JOINT WITH FOLIATION, OXIDIZED, ROUGH, TIGHT. FROM 55.7' TO 56.5', TWO FOLIATION JOINTS, OXIDIZED, SMOOTH, TIGHT.
70 30	R5	62'-72'	99% REC 92% RQD							AT 56.5' AND 63', TWO 60-DEGREE JOINTS ACROSS FOLIATION, OXIDIZED, SMOOTH, TIGHT.
80 40										

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B34-99
LINE & STA. N:322,813.48
OFFSET E:625,136.85

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE, START: 2-9-99
DATE, FINISH: 2-10-99

GROUND ELEVATION 187.81
GROUND WATER ELEVATION ____

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER ____ LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80		R6	72'-82'	96% REC 92% RQD							FROM 56.5' TO 58', A SUBVERTICAL JOINT ACROSS FOLIATION, OXIDIZED, ROUGH, TIGHT. FROM 64.3' TO 65', ROCK IS SOFT, FRIABLE, OXIDIZED, ALONG A 50-DEGREE FOLIATION JOINT. FROM 65' TO 99', MODERATELY CLOSE JOINT SPACING. AT 85.5', 88' AND 90.5', 70-DEGREE JOINTS ACROSS FOLIATION, OXIDIZED, ROUGH, TIGHT. IN GENERAL, THE ROCK IS GOOD FROM 40.3' TO 99'.(1-65) FROM 99' TO 101.5', ROCK IS WEATHERED, FRACTURED, FRIABLE, SOFT, OXIDIZED, WITH SIX 10-DEGREE JOINTS, OXIDIZED, ROUGH, OPEN. ROCK QUALITY IMPROVES BELOW 101.5'. (3-65/2-65)
90		R7	82'-89'	99% REC 90% RQD							
10											
		R8	89'-97'	99% REC 81% RQD							
100											
20											
		R9	97'-105'	88% REC 68% RQD						105'	
110											
30											
120											END OF HOLE 105'
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B35-99
LINE & STA. N:322,992.78
OFFSET E: 625,158.76

DEPTH ____ FT ____ FT CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE START: 2-1-99
DATE FINISH: 2-2-99

GROUND ELEVATION 183.24
GROUND WATER ELEVATION 175.13 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. : FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	10"	5	7	7	6		0'-2'	TOPSOIL (6"). DARK SAND, ORGANIC MATTER. MEDIUM DENSE. (SM) (11-65)
		SS2	2'-4'	12"	7	10	17	23			
		SS3	4'-6'	14"	14	14	20	15			RUSTY BROWN SILTY FINE SAND, TRACE TO SOME GRAVEL. DENSE TO VERY DENSE. (SM, SP-SM) (7-65)
		SS4	6'-8'	5"	71	36	38	43		8'	
		SS5	8'	0"	100	/0"					
10											GREENISH GRAY SILTY SAND, SOME TO LITTLE GRAVEL, COBBLES AND BOULDERS. VERY DENSE. TILL MATERIAL. (SM AND GM) (6-65/5-65)
		SS6	10'-12'	8"	22	44	78	100		15'	
								/3"			
		SS7	12'-14'	4"	55	100	/2"				
		SS8	15'	0"	100	/0"					
		SS9	16'-18'	10"	20	26	36	30	WASH		
		10	18'-19.2'	6"	45	53	100	/3"			
20										21'	YELLOW BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS (GNEISS), COBBLES. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
		R1	21'-27'	20%	REC						
				6%R	QD						
30											GNEISS. MEDIUM GRAY.
											HIGHLY WEATHERED, SOFT TO MODERATELY HARD, FRACTURED, OXIDIZED FROM 21' TO 32'. FOLIATION AT 70 TO 85 DEGREES. NUMEROUS FRACTURES AT 20 TO 30 DEGREES, WITH FOLIATION TREND,
		R2	27'-37'	65%	REC						
40				30%	RQD						

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B35-99
LINE & STA N:322,992.78
OFFSET E: 625,158.76

DEPTH ____ FT ____ FT CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE, START: 2-1-99
DATE, FINISH: 2-2-99

GROUND ELEVATION 183.24
GROUND WATER ELEVATION 175.13 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0 6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											IRON STAINED. (4-65: ROCK QUALITY IMPROVES AT 32'. FROM 32' TO 40.5', MODERATELY HARD, WEATHERED, CLOSE JOINT SPACING. SUB-VERTICAL JOINT FROM 37.5' TO 38.5'. SOME OXIDATION ON JOINTS. (3-65)
40											
		R3	37'-47'	98% REC 75% RQD							
50											
10											
		R4	47'-57'	98% REC 96% RQD							MODERATELY CLOSE JOINT SPACING BELOW 40.5'. FOLIATION AT 60 DEGREES TO SUBVERTICAL. AT 54.7', AN 80-DEGREE FOLIATION JOINT, OXIDIZED, ROUGH, OPEN, AND A 40-DEGREE JOINT WITH FOLIATION TREND, OXIDIZED,
60											
20											
		R5	57'-65'	99% REC 96% RQD						65'	ROUGH, OPEN. (1-65)
70											END OF HOLE 65'
30											
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B36-99
LINE & STA. N:323,189.97
OFFSET E:625,184.19

DEPTH _____ FT. ____ FT CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE. _____

DATE. START: 2-25-99
DATE. FINISH: 2-26-99

GROUND ELEVATION 182.43
GROUND WATER ELEVATION 169.06 3/24/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	20"	4	3	3	4		0'-	TOPSOIL (4"). RUSTY BROWN SILTY F-M SAND, TRACE GRAVEL, COBBLES. LOOSE TO VERY DENSE. (SM) (7-65)
		SS2	2'-4'	18"	6	6	7	9			
		SS3	4'-6'	16"	9	9	14	15			
		SS4	6'-7.2'	NR	4	9	56	100	/3"		
		SS5	8'-8.1'	1"	100	/2"					
10		SS6	10'-12'	15"	14	18	29	34			ROLLER BIT FROM 12' TO TOP OF ROCK
										16'	GNEISS. LIGHT GRAY TO MEDIUM GRAY. HARD. QUARTZITIC FROM 26' TO 31.5'; 43' TO 45'; AMPHIBOLITIC FROM 31.5' TO 36'; 51' TO 61'. FOLIATION AT 50 DEGREES TO SUBVERTICAL. OXIDATION ON JOINTS TO 20.5'. SLIGHTLY WEATHERED TO UNWEATHERED ROCK.
20											
		R1	16'-26'	98% REC							
				65% RQD							
30											
		R2	26'-36'	99% REC							FROM 16' TO 21' CLOSE JOINT SPACING. (3-65) GOOD ROCK BEGINS AT 21'. MODERATELY JOINTED TO MASSIVE BELOW 21'.
				82% RQD							
40											

Soil Engineer: _____ Driller: GUS SURI

Drilling Inspector: _____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B36-99
LINE & STA. N:323,189.97
OFFSET E:625,184.19

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-25-99
DATE. FINISH: 2-26-99

GROUND ELEVATION 182.43
GROUND WATER ELEVATION 169.06 3/24/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											FROM 16.25' TO 16.8', A 60-DEGREE FOLIATION JOINT, SMOOTH, OPEN, OXIDIZED. FROM 18.25' TO 20.25', A SUB-VERTICAL FOLIATION JOINT, OPEN, SMOOTH, OXIDIZED, WITH THREE 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OXIDIZED. FROM 31.5' TO 32', A 60-DEGREE JOINT WITH FOLIATION TREND, ROUGH, TIGHT WITH TWO 70-DEGREE FOLIATION JOINTS, ROUGH, TIGHT. FROM 36' TO 46', A SINGLE CORE PIECE RECOVERED. (1-65)
40											
		R3	36'-46'	98% REC							
				98% RQD							
50											
10											
		R4	46'-56'	100 %	REC						
				95% RQD							
60											
20											
		R5	56'-61'	99% REC						61'	
				96% RQD							END OF HOLE 61'
70											WATER PRESSURE TESTS IN ROCK FROM 20' TO 61'.
30											TWO PIEZOMETERS INSTALLED AT 16' AND 58.5'.
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B37-99
LINE & STA. N:323,357.28
OFFSET E:625,222.24

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START: 3-10-99
DATE. FINISH: 3-16-99

GROUND ELEVATION 175.48
GROUND WATER ELEVATION -

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	ANGLED BOREHOLE DIRECTION: S 10 DEGREES W ANGLE 60 DEGREES ROLLER BIT TO TOP OF ROCK NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL
10											
20										21'	
30 N		R1	21'-30'	100 % REC 75% RQD							GNEISS. LIGHT GRAY, HIGHTLY WEATHERED FROM 22' TO 26', THE REST MODERATELY WEATHERED TO UN-WEATHERED. QUARTZ-ITIC FROM 40' TO 60', 68.5' TO 79', 102' TO 104'. FOILATION AT 40 DE-GREES TO SUB-VERTICAL, MOSTLY AT 70 DEGREES. OXIDATION ON JOINTS TO 26' AND AT 46.75'. VERY CLOSE JOINT SPACING FROM 24' TO 26'.
40		R2	30'-40'	98% REC 90% RQD							

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B37-99
LINE & STA. N:323,357.28
OFFSET E:625,222.24

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE. ____

DATE. START: 3-10-99
DATE. FINISH: 3-16-99

GROUND ELEVATION 175.48
GROUND WATER ELEVATION -

CASING O.D. HW I.D. ____
SAMPLER O.D 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											MAINLY FOLIATION JOINTS, OXIDIZED. MODERATELY CLOSE JOINT SPACING BELOW 26'. IN GENERAL, ROCK IS MODERATELY JOINTED BELOW 26'. FROM 21' TO 22.8', A SUBVERTICAL FOLIATION JOINT, ROUGH, OXIDIZED, SOFT FROM 22' TO 22.8', WITH FOUR 30-DEGREE JOINTS ACROSS FOLIATION, ROUGH. FROM 21' TO 26'. (2-65) ROCK CLASS. AT 39.8', A FOLIATION JOINT AT 85 DEGREES, SMOOTH, TIGHT. FROM 60' TO 60.5', AND FROM 61.5' TO 62.25', TWO FOLIATION JOINTS AT 80 DEGREES, ROUGH, TIGHT. AT 63', A 60-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. ACROSS IN GENERAL, VERY GOOD QUALITY ROCK BELOW 26'. (1-65)
40											
50											
10		R3	40'-50'	100 %	REC						
				98%	RQD						
60											
20		R4	50'-60'	100 %	REC						
				100 %	RQD						
70											
30		R5	60'-70'	100 %	REC						
				97%	RQD						
80		R6	70'-80'	99%	REC						
40				97%	RQD						

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B37-99
LINE & STA. N:323,357.28
OFFSET E:625,222.24

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT ALL CASING OUT DATE. _____

DATE. START: 3-10-99
DATE. FINISH: 3-16-99

GROUND ELEVATION 175.48
GROUND WATER ELEVATION —

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80											
90											
10		R7	80'-90'	98% REC 98% RQD							
100											
20		R8	90'-100'	98% REC 98% RQD							
		R9	100'-105'	97% REC 90% RQD						105'	END OF HOLE 105'
110											
30											
120											
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B38-99
LINE & STA. N:323,518.23
OFFSET E:625,223.30

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-22-99
DATE. FINISH: 2-23-99

GROUND ELEVATION 176.99
GROUND WATER ELEVATION 170.11 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	24"	1	1	1	1		0'-	RUSTY BROWN SILTY FINE SAND. LOOSE TO DENSE. (SM)
		SS2	2'-4'	18"	7	11	13	22		4'	(7-65)
		SS3	4'-5.5'	12"	16	26	100	/6"			BROWN SILTY F-M SAND, TRACE GRAVEL,
		SS4	6'-6.5'	4"	100	/6"				7'	COBBLES. DENSE. (SM) (6-65)
10		R1	7'-12'	60"	REC						GNEISS. MEDIUM GRAY, SCHISTOSE FROM 7' TO 12'. FOLIATION AT 70 DEGREES. OXIDATION ON JOINTS TO 19.5'.
				38%	RQD						
		R2	12'-17'	83%	REC						FRACTURED, WEATHERED FROM 7' TO 12'; SEVERAL STEEP FOLIATION JOINTS,
				33%	RQD						
20		R3	17'-20'	100 %	REC					20'	OXIDIZED FROM 12' TO 16'. (3-65)
				85%	RQD						ROCK QUALITY IMPROVES FROM 16'. FOLIATION JOINTS PRODOMINANT FROM 16'.
30											FROM 15' TO 16', A SUBVERTICAL FOLIATION JOINT, SMOOTH, OXIDIZED, TIGHT, WITH TWO 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, SLIGHTLY OXIDIZED.
40											

Soil Engineer: ____ Driller: GREG MARNEY JR.

Drilling Inspector: ____ Helper: THEO RODRIGUEZ

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B38-99
LINE & STA. N:323,518.23
OFFSET E:625,223.30

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-22-99
DATE. FINISH: 2-23-99

GROUND ELEVATION 176.99
GROUND WATER ELEVATION 170.11 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
		0								FROM 18.5' TO 19.5', A CURVED FOLIATION JOINT, ROUGH, OXIDIZED, TIGHT, WITH TWO 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, SOME OXIDATION, TIGHT. (2-65)
		10								END OF HOLE 20'
		20								PIEZOMETER INSTALLED AT 18'.
		30								
		40								

Soil Engineer: ____ Driller: GREG MARNEY JR.

Drilling Inspector: ____ Helper: THEO RODRIGUEZ

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B39-99
LINE & STA N:322,835.71
OFFSET E:625,248.43

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE. START: 2-2-99
DATE. FINISH: 2-4-99

GROUND ELEVATION 179.20
GROUND WATER ELEVATION 172.18 2/5/99

CASING O.D HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	6"	2	2	4	2		0'-2'	TOPSOIL (6"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE, (SM) (11-65)
		SS2	2'-4'	8"	3	4	4	4			
		SS3	4'-6'	10"	9	9	5	5		6'	TAN BROWN SILTY FINE SAND, TRACE GRAVEL. LOOSE TO MEDIUM DENSE. (SM) (7-65)
		SS4	6'-8'	10"	46	48	25	60			
10		SS5	8'-10'	0"	100	/2"					YELLOW BROWN SILTY F-M SAND, TRACE TO SOME GRAVEL, ROCK FRAGMENTS, MICA, COBBLES. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
		SS6	10'-12'	8"	99	96	90	91			
		SS7	12'-14'	12"	30	32	31	31			
		SS8	14'-16'	14"	25	31	30	33		16'	
20		R1	16'-21'	60% REC 52% RQD							GNEISS. LIGHT GRAY. SLIGHTLY WEATHERED TO UNWEATHERED, OXIDIZED ON JOINTS TO 28' AND AT 50.9', 61.5', AND 65.5'.
		R2	21'-25'	92% REC 88% RQD							SOFT TO MODERATELY HARD. FRACTURED FROM 16' TO 18'. FROM 16' TO 16.5' AND 16.8' TO 17.2', TWO SUBVERTICAL FOLIATION JOINTS, SMOOTH. (3-65)
30		R3	25'-30.5'	96% REC 85% RQD							ROCK QUALITY IMPROVES AT 18'; UNWEATHERED, HARD,
40		R4	30.5'-40.5'	99% REC 87% RQD							

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO MG-B39-99
LINE & STA N:322,835.71
OFFSET E:625,248.43

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-2-99
DATE. FINISH: 2-4-99

GROUND ELEVATION 179.20
GROUND WATER ELEVATION 172.18 2/5/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. : FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										MODERATELY CLOSE JOINT SPACING. FOLIATION AT 60 DEGREES TO SUB-VERTICAL. AT 23.7' A 70-DEGREE FOLIATION JOINT, SMOOTH, MICA AT 45' AND 51.7', TWO 60-DEGREE FOLIATION JOINTS, SMOOTH, TIGHT, WITH A 70-DEGREE JOINT ACROSS FOLIATION.
40										
50										
10	R5	40.5'-50.5'	98% REC 90% RQD							
60										OXIDIZED FROM 61' TO 61.5'. GENERALLY GOOD ROCK. (2-65)
20	R6	50.5'-60.5'	96% REC 93% RQD							
	R7	60.5'-65.5'	98% REC 86% RQD						65.5'	
70										END OF HOLE 65.5'
30										
80										
40										

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B40-99
LINE & STA. N:323,081.15
OFFSET E:625,270.16

DEPTH ____ FT. ____ IT CASING OUT DATE: ____
DEPTH ____ IT ALL CASING OUT DATE: ____

DATE START: 1-28-99
DATE FINISH: 1-29-99

GROUND ELEVATION 177.77
GROUND WATER ELEVATION 171.43 2/1/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	12"	2	4	4	5		0'-2'	TOPSOIL (3"). DARK GRAY SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
	SS2	2'-4'	14"	5	10	11	16			
	SS3	4'-6'	12"	12	14	11	12			RUSTY BROWN SILTY FINE SAND, TRACE TO SOME GRAVEL, COBBLES, BOULDERS. MEDIUM DENSE TO
	SS4	6'-8'	2"	10	100	/1"			10'	DENSE. (SM) (6-65)
	SS5	10'-11.5'	12"	20	37	100	/3"		11.5'	YELLOW BROWN SILTY F-M SAND WITH MICA, ROCK FRAGMENTS.
										VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
	R1	11.5'-21.5'	90% REC 90% RQD							GNEISS. LIGHT GRAY TO 34', QUARTZITIC FROM 20.5' TO 31.5' MEDIUM GRAY BELOW 34'. WEATHERED TO 32'. FOLIATION AT 30 TO 70 DEGREES. OXIDATION ON JOINTS TO 38'.
	R2	21.5'-31.5'	93% REC 54% RQD							FROM 11.5' TO 20.3', HARD, SLIGHTLY WEATHERED, MODERATELY CLOSE JOINT SPACING. FROM 20.3' TO 20.6', A 60-DEGREE FOLIATION JOINT, ROUGH, TIGHT. FRACTURED, WEATHERED AND OXIDIZED

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B40-99
LINE & STA. N:323,081.15
OFFSET E:625,270.16

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE, START: 1-28-99
DATE, FINISH: 1-29-99

GROUND ELEVATION 177.77
GROUND WATER ELEVATION 171.43 2/1/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		R3	31.5'-41.5'	96% REC 72% RQD							ON JOINTS FROM 23' TO 34'. FROM 26.5' TO 30', FOURTEEN 30-DEGREE FOLIATION JOINTS, OXIDIZED, ROUGH. FRIABLE, SOFT FROM 28.5' TO 29.5', POSSIBLE SHEARING. FROM 30.5' TO 31.5', A 70-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, TIGHT WITH TWO 30-DEGREE FOLIATION JOINTS, ROUGH, TIGHT, OXIDIZED.
40											
50											
10		R4	41.5'-51.5'	98% REC 96% RQD							
60											
20		R5	51.5'-61'	98% REC 98% RQD						61'	FROM 23.7' TO 31.5', CLOSE JOINT SPACING. AT 32.5', A 70-DEGREE JOINT ACROSS FOLIATION, ROUGH, OXIDIZED, TIGHT. (3-65) BELOW 34', ROCK QUALITY IMPROVES WITH MODERATELY CLOSE JOINT SPACING AND WIDE JOINT SPACING BELOW 50.5'. AT 37.5', A 10-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, TIGHT.
70											
30											
80											
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B40-99
LINE & STA. N:323,081.15
OFFSET E:625,270.16

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 1-28-99
DATE. FINISH: 1-29-99

GROUND ELEVATION 177.77
GROUND WATER ELEVATION 171.43 2/1/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											FROM 48' TO 48.5', A 60-DEGREE FOLIATION JOINTS, SMOOTH, MICA, TIGHT. AT 54.7', A 70-DEGREE FOLIATION JOINT, SMOOTH, TIGHT. (1-65)
10											END OF HOLE 61'
20											
30											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B41-99
LINE & STA. N:323,329.79
OFFSET E:625,288.24

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 1-27-99
DATE. FINISH: 1-27-99

GROUND ELEVATION 177.25
GROUND WATER ELEVATION 166.51 2/1/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	10"	2	4	2	3		0'-2'	TOPSOIL (3"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
		SS2	2'-4'	2"	100	/2"				4'	RUSTY BROWN SILTY FINE SAND, TRACE GRAVEL. (SM) (7-65) ROLLER BIT FROM 4' TO 7'
10		R1	7'-12'	100 %	REC						GNEISS. LIGHT GRAY TO 11.5', QUARTZITIC BANDS; MEDIUM GRAY BELOW 11.5'. UNWEATHERED. OXIDATION ON JOINTS TO 25'. FOLIATION AT 60 DEGREES.
				99% RQD							
20		R2	12'-22'	85% REC							FROM 7' TO 16', MODERATELY CLOSE TO WIDE JOINT SPACING. FROM 8.9' TO 9.5', A 70-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. (1-65)
				71% RQD							
		R3	22'-25'	100 %	REC					25'	
				84% RQD							FROM 16' TO 22.5', CLOSE JOINT SPACING. FROM 17.7' TO 18.5', A 60-DEGREE FOLIATION JOINT, OXIDIZED, TIGHT. A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH, OPEN; A 75-DEGREE JOINT WITH FOLIATION TREND.
30											
40											

Soil Engineer: _____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: _____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B41-99
LINE & STA. N:323,329.79
OFFSET E:625,288.24

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 1-27-99
DATE. FINISH: 1-27-99

GROUND ELEVATION 177.25
GROUND WATER ELEVATION 166.51 2/1/99

CASING O.D. HW I D ____
SAMPLER O.D. 2" I D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											TIGHT. (3-65)
											ROCK QUALITY IM-PROVES BELOW 22.5'. MODERATELY CLOSE JOINT SPACING. (2-65)
											END OF HOLE 25'
10											
20											
30											
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B42-99
LINE & STA. N:322,831.98
OFFSET E:625,338.22

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT ALL CASING OUT DATE: _____

DATE, START: 2-11-99
DATE, FINISH: 2-16-99

GROUND ELEVATION 174.93
GROUND WATER ELEVATION 170.48 3/24/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	18"	3	3	3	3		0'-	TOPSOIL (3"). DARK BROWN SILT WITH SAND, ORGANIC MATTER IN TOP 2 FEET. FIRM TO
	SS2	2'-4'	18"	4	6	5	5			
	SS3	4'-6'	18"	5	6	7	9		6'	STIFF. (ML)(11-65)
	SS4	6'-8'	18"	32	33	40	38			YELLOW BROWN SILTY SAND, TRACE TO SOME GRAVEL. VERY DENSE. (SM) (6-65)
	SS5	8'-10'	18"	27	28	30	32			
	SS6	10'-12'	16"	23	85	27	28			
									15'	
	R1	15'-17'	86% REC 0% RQD							GNEISS. LIGHT TO MEDIUM GRAY. WEATHERED TO 19'. OXIDATION ON JOINTS TO 43'.
	R2	17'-21.5'	80% REC 79% RQD							SOFT, WEATHERED, FRACTURED FROM 15' TO 17', OXIDIZED. FOLIATION AT 40 DEGREES. (4-65)
	R3	21.5'-26.5'	96% REC 76% RQD							FROM 15.3' TO 15.7' A SUBVERTICAL JOINT, OXIDIZED, FRIABLE, SOFT.
	R4	26.5'-34'	96% REC 68% RQD							ROCK QUALITY IMPROVES AT 17'. FROM 17' TO 25'. MODERATELY HARD TO HARD, CLOSE TO MODERATELY CLOSE JOINT SPACING.

Soil Engineer: _____ Driller: CESAR MORIERA

Drilling Inspector: _____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B42-99
LINE & STA. N:322,831.98
OFFSET E:625,338.22

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-11-99
DATE. FINISH: 2-16-99

GROUND ELEVATION 174.93
GROUND WATER ELEVATION 170.48 3/24/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R5	34'-42'	91% REC 82% RQD							FOLIATION AT 40 TO 60 DEGREES. SOME SUBHORIZONTAL AND FOLIATION JOINTS, OXIDIZED. A SMOOTH FOLIATION JOINT AT 60 DEGREES, OXIDIZED, AT 19.8'. ESSENTIALLY GOOD ROCK. (2-65)
50											
10		R6	42'-52'	98% REC 98% RQD							FROM 25' TO 34', CLOSE JOINT SPACING. FOLIATION AT 60 AND 70 DEGREES. 60 AND 70-DEGREE JOINTS ACROSS FOLIATION AT 27.5' (SMOOTH) AND 28' (ROUGH), INTERSECTED BY 30 AND 40-DEGREE JOINTS. SMOOTH 70 AND 60-DEGREE JOINTS, OXIDIZED, AT 33.5' (ACROSS FOLIATION) AND 33.8' (FOLIATION JOINT). (3-65)
60											
20		R7	52'-60'	92% REC 70% RQD						60'	FROM 34' TO 55', CLOSE TO MODERATELY CLOSE JOINT SPACING. FROM 34' TO 34.5', A ROUGH FOLIATION JOINT AT 70 DEGREES, ALTERATION IN EPIDOTE AND CHLORITE. (1-65)
70											
30											
80											BELOW 56', SUB-VERTICAL FOLIATION
40											

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B42-99
LINE & STA. N:322,831.98
OFFSET E:625,338.22

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-11-99
DATE. FINISH: 2-16-99

GROUND ELEVATION 174.93
GROUND WATER ELEVATION 170.48 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
		0								AND CLOSE TO MODERATELY CLOSE JOINT SPACING. FROM 52.2' TO 55.8', A SMOOTH FOLIATION JOINTS AT 60 DEGREES. (2-65)
		10								END OF HOLE 60' ORIENTED CORE FROM 25' TO 60'. WATER PRESSURE TESTS IN ROCK FROM 15' TO 60'. PIEZOMETER INSTALLED AT 52'.
		20								
		30								
		40								

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B43-99
LINE & STA. N:322,918.19
OFFSET E:625,351.04

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE. START: 1-28-99
DATE. FINISH: 1-29-99

GROUND ELEVATION 174.84
GROUND WATER ELEVATION 169.62 2/1/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	10"	3	3	4	4		0'-2'	TOPSOIL (3"). DARK BROWN SILTY SAND, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-4'	12"	4	8	7	20		4'	DARK BROWN SILT WITH SAND. STIFF. (ML) (11-65)
		SS3	4'-6'	8"	14	20	16	21			
		SS4	6'-8'	10"	15	16	17	17			RUSTY BROWN SILTY FINE SAND, SOME GRAVEL, COBBLES. (SP-SM AND GP-GM) (6-65)
10		SS5	8'-10'	3"	100	/3"				11'	
		SS6	10'-12'	10"	17	20	45	45			
		SS7	12'-14'	6"	12	15	16	15			YELLOW BROWN SILTY F-M SAND, WITH GRAVEL, MICA, ROCK FRAGMENTS(GNEISS), COBBLES. DENSE TO VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED) ROCK). (SM AND GM) (6-65/5-65)
		SS8	14'-16'	8"	21	19	33	45			
		SS9	16'-17'	2"	100	/2"				17'	
20											
		R1	17.5'-27.5'	98% REC 85% RQD							GNEISS. MEDIUM GRAY. SLIGHTLY SCHISTOSE FROM 35' TO 51'. FOLIATION FROM 50 DEGREES TO SUBVERTICAL. QUARTZ BAND FROM 47' TO 48'. OXIDATION ON JOINTS TO 45.5'. FROM 22' TO 23.8', A SUBVERTICAL FOLIATION JOINT, OXIDIZED, SMOOTH, OPEN WITH FOUR 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OPEN.
30											
		R2	27.5'-37.5'	98% REC 86% RQD							
		R3	37.5'-40.5'	96% REC 78% RQD							
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B43-99
LINE & STA. N:322,918.19
OFFSET E:625,351.04

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE, START: 1-28-99
DATE, FINISH: 1-29-99

GROUND ELEVATION 174.84
GROUND WATER ELEVATION 169.62 2/1/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											
50											
10		R4	40.5'-50.5'	98% REC 84% RQD							
		R5	50.5'-56'	100 % REC 100 % RQD						56'	
60 20											
70											
30											
80											
40											

FROM 24.5' TO 25.2' AND 25.4' TO 26.25', TWO SUB-VERTICAL FOLIATION JOINTS, SMOOTH, TIGHT.
FROM 31' TO 32.5', FRACTURED ZONE, SOFT, FRIABLE.
FROM 30.6'TO 31.1', AN 80-DEGREE FOLIATION JOINT, ROUGH, OPEN.
FROM 32' TO 32.5', A 70-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, ROUGH.
FROM 33.75' TO 34.1', A 70-DEGREE FOLIATION JOINT, OXIDIZED, SMOOTH, TIGHT.
FROM 34.1'TO 34.8', A 70-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, ROUGH, WTIH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT.

ROCK QUARTZITE IMPROVES FROM 35' TO 38.2'. CLOSELY JOINTED FROM 38.2' TO 42.1'. FROM 38.2' TO 38.9' A FOLIATION JOINT, OXIDIZED, SMOOTH, TIGHT WITH A 10-DEGREE JOINT ACROSS

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B43-99
LINE & STA. N:322,918.19
OFFSET E:625,351.04

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT ALL CASING OUT DATE: _____

DATE, START: 1-28-99
DATE, FINISH: 1-29-99

GROUND ELEVATION 174.84
GROUND WATER ELEVATION 169.62 2/1/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											FOLIATION, ROUGH.
											FOLIATION JOINTS BELOW 41' ARE SMOOTH, TIGHT. IN GENERAL GOOD ROCK FROM 17' TO 42.1'. (2-65)
10											ROCK QUALITY IMPROVES BELOW 42.1'. (1-65)
											END OF HOLE 56'
20											
30											
40											

Soil Engineer: _____ Driller: GUS SURI

Drilling Inspector: _____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B44-99
LINE & STA. N:323,014.73
OFFSET E:625,391.41

DEPTH _____ FT. ____ FT. CASING OUT DATE. _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-4-99
DATE. FINISH: 2-5-99

GROUND ELEVATION 174.13
GROUND WATER ELEVATION _____

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER _____ LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	ANGLED BOREHOLE DIRECTION: N 82 DEGREES W ANGLE:60 DEGREE ROLLER BIT TO TOP OF ROCK NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL
10											
20		R1	19'-22'	99% REC 55% RQD						19'	GNEISS. LIGHT TO MEDIUM GRAY, SCHISTOSE. FOLIATION AT 30 DEGREES TO SUB-VERTICAL. OXIDATION ON JOINTS TO 25'. CLOSE JOINT SPACING TO 21'. (3-65) MODERATELY CLOSE SPACING FROM 21' TO 96.25'. ROUGH FOLIATION JOINTS PREDOMINATE FROM 19' TO 22' AND BELOW 72'.
30		R2	22'-32'	99% REC 91% RQD							
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B44-99
LINE & STA. N:323,014.73
OFFSET E:625,391.41

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-4-99
DATE. FINISH: 2-5-99

GROUND ELEVATION 174.13
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER ____ LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R3	32'-42'	99% REC 96% RQD							GENERALLY SMOOTH FOLIATION JOINTS FROM 32' TO 72'. A 50-DEGREE JOINT ACROSS FOLIATION AT 87.5'. AT 93.8', A SUB-VERTICAL FOLIATION JOINT, ROUGH, WITH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. FROM 95.25' TO 95.75', A SMOOTH SUBVERTICAL JOINT WITH FOLIATION TREND, WITH 20-DEGREE JOINT ACROSS FOLIATION, TIGHT, ROUGH. CLOSELY TO MODERATELY JOINTED FROM 96.25' TO 100.9'. MODERATELY CLOSE JOINT SPACING BELOW 100.9'. FROM 96.25' TO 98.25', A SMOOTH 80-DEGREE JOINT ACROSS FOLIATION, TIGHT, WITH FOUR 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, TIGHT. A SUBVERTICAL FOLIATION JOINT FROM 98.5' TO 99'.
50											
10											
		R4	42'-52'	99% REC 78% RQD							
60											
20											
		R5	52'-62'	99% REC 98% RQD							
70											
30											
		R6	62'-72'	99% REC 90% RQD							
80											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B44-99
LINE & STA. N:323,014.73
OFFSET E:625,391.41

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE. _____

DATE, START: 2-4-99
DATE, FINISH: 2-5-99

GROUND ELEVATION 174.13
GROUND WATER ELEVATION _____

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER _____ LBS.
INSIDE LENGTH OF SAMPLER _____ IN.

HAMMER FALL
CASING _____ SAMPLER _____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80		R7	72'-82'	99% REC 93% RQD							IN GENERAL, THE ROCK IS GOOD BELOW 21'. (1-65)
90											
10											
		R8	82'-92'	99% REC 98% RQD							
100											
20											
		R9	92'-102'	99% REC 73% RQD							
		R10	102'-105'	99% REC 99% RQD						105'	
110											END OF HOLE 105'
30											
120											
40											

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO: MG-B45-99
LINE & STA. N:323,116.78
OFFSET E:625,374.89

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-8-99
DATE. FINISH: 2-10-99

GROUND ELEVATION 176.79
GROUND WATER ELEVATION 168.24 3/24/99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	18"	12	14	15	17		0'-2'	TOPSOIL(3). DARK GRAY SILT WITH SAND, ORGANIC MATTER. (ML)(11-65)
		SS2	2'-4'	18"	4	5	5	6		4'	RUSTY BROWN SILTY FINE SAND. (SM) (7-65)
		SS3	4'-6'	18"	10	11	11	11		6'	DARK GRAY SILT WITH FINE SAND. (ML) (11-65)
		SS4	6'-8'	18"	5	6	9	8		8'	YELLOW BROWN SILTY F-M SAND. MEDIUM DENSE. (SM) (7-65)
		SS5	8'-8.1'	NR	100	/1"				14.5'	POSSIBLE SAPROLITIC SOIL. BOULDERS. DENSE. (SM AND GM) (6-65/5-65)
10		SS6	10'	NR	100	/0"					
20		R1	14.5'-19.5'	93%	REC						GNEISS. MEDIUM GRAY. SLIGHTLY WEATHERED TO UN-WEATHERED. FOLIATION FROM 60 TO 80 DEGREES. OXIDATION ON JOINTS TO 20.5', AT 38' AND 49.5'. A 70 DEGREE FOLIATION JOINT, OXIDIZED, FROM 16.8' TO 17.4'. CLOSELY JOINTED FROM 16' TO 18.5', 31.6' TO 38', 45' TO 50'. MODERATELY CLOSE JOINT SPACING IN THE REST OF THE CORE. (2-65/1-65)
				81%	RQD						
		R2	19.5'-21.5'	99%	REC						
				98%	RQD						
		R3	21.5'-22.5'	68%	REC						
				68%	RQD						
30		R4	22.5'-32.5'	96%	REC						
				93%	RQD						
40											

Soil Engineer: _____ Driller: CESAR MORIERA

Drilling Inspector: _____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B45-99
LINE & STA. N:323,116.78
OFFSET E:625,374.89

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 2-8-99
DATE. FINISH: 2-10-99

GROUND ELEVATION 176.79
GROUND WATER ELEVATION 168.24 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R5	32.5'-42.5'	99% REC 80% RQD							
50											
10		R6	42.5'-50'	99% REC 77% RQD							
		R7	50'-55'	99% REC 99% RQD						55'	
60											END OF HOLE 55' ORIENTED CORE FROM 20' TO 55'. WATER PRESSURE TESTS IN ROCK FROM 15' TO 55'. PIEZOMETER INSTALLED AT 53'.
20											
70											
30											
80											
40											

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B46-99
LINE & STA. N:323,215.85
OFFSET E:625,387.39

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 1-25-99
DATE. FINISH: 1-26-99

GROUND ELEVATION 175.44
GROUND WATER ELEVATION 166.62 2/1/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	8"	8	8	9	14		0'-2'	TOPSOIL (1.5"). DARK GRAY SILTY SAND, ORGANIC MATTER. MEDIUM DENSE. (SM) (11-65)
		SS2	2'-4'	18"	7	10	12	21			
		SS3	4'-6'	2"	38	56	69	100		6'	RUSTY BROWN SILTY FINE SAND, TRACE GRAVEL, COBBLES (SM) (6-65)
		SS4	6'-7'	9"	28	100	/3"				
10											
		R1	7.5'-12.5'	17%	REC	BOU	LDE	RS			YELLOW BROWN SILTY F-M SAND, MICA, ROCK FRAGMENTS (GNIESS), COBBLES AND BOULDERS. POSSIBLE SAPROLITIC SOIL. (SM AND GM) (6-65/5-65)
		R2	12.5'-13.5'	50%	REC	BOU	LDE	RS			
		SS5	13.5'-14'	6"	100	/6"				14'	
20		R3	15.5'-20'	100 %	REC						GNEISS. MEDIUM GRAY. QUARTZITIC FROM 39' TO 45', 48' TO 50'. FOLIATION AT 70 DEGREES TO SUB-VERTICAL. OXIDATION ON JOINTS UP TO 37.5'. FROM 15.75' TO 16.5', A 70-DEGREE FOLIATION JOINT, SLIGHTLY OXIDIZED, SMOOTH. FROM 22.8' TO 24.3', AN 80-DEGREE FOLIATION JOINT, OXIDIZED, ROUGH.
				98%	RQD						
30		R4	20'-30'	98%	REC						
				93%	RQD						
40		R5	30'-40'	100 %	REC						
				96%	RQD						

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B46-99
LINE & STA. N:323,215.85
OFFSET E:625,387.39

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE. _____

DATE. START: 1-25-99
DATE. FINISH: 1-26-99

GROUND ELEVATION 175.44
GROUND WATER ELEVATION 166.62 2\1\99

CASING O.D. HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											FROM 45' TO 48', A SUBVERTICAL FOLIATION JOINT, SMOOTH, FRIABLE, SOFT, MUSCOVITE. IN GENERAL GOOD ROCK, MODERATELY JOINTED. (1-65)
50											
10		R6	40'-50'	100 % REC 88% RQD						50'	
											END OF HOLE 50'
60											
20											
70											
30											
80											
40											

Soil Engineer: _____ Driller: GUS SURI

Drilling Inspector: _____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO. MG-B47-99
LINE & STA. N:323,321.30
OFFSET E:625,396.15

DEPTH ____ FT. ____ FT CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 1-25-99
DATE. FINISH: 1-26-99

GROUND ELEVATION 172.97
GROUND WATER ELEVATION 163.05 2/1/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	18"	4	5	6	6		0'-2'	TOPSOIL (3"). DARK GRAY SILTY SAND, TRACE GRAVEL, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-4'	18"	10	10	6	7			
		SS3	4'-6'	12"	18	32	56	100			RUSTY BROWN SILTY F-M SAND, SOME GRAVEL, COBBLES AND BOULDERS. MEDIUM DENSE TO VERY DENSE. (SP-SM AND GP-GM) (6-65)
		SS4	6'-6.5'	5"	100	/5"		/2"			
10										13'	ROLLER BIT FROM 6.5' TO 8', FROM 13.5' TO 15'
		R1	8'-13'	14%	REC						
		SS5	13'-13.5'	3"	100	/3"					
20		R2	15'-20'	95%	REC					15'	YELLOW BROWN SILTY F-M SAND, MICA, ROCK FRAGMENTS, COBBLES. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
				78%	RQD					20'	GNEISS. LIGHT GRAY, QUARTZ BAND FROM 17.5' TO 18.5'. WEATHERED, FRACTURED, OXIDIZED, SOFT AND FRIABLE FROM 15' TO 17'. (3-65) MODERATELY JOINTED FROM 17' TO 20', STEEP FOLIATION. (1-65)
30											END OF HOLE 20'
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B48-99
LINE & STA N:322,750.80
OFFSET E:625,279.85

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 1-28-99
DATE. FINISH: 2-1-99

GROUND ELEVATION 179.30
GROUND WATER ELEVATION 171.05 2/1/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	8"	6	7	7	7		0'-	TOPSOIL (2"). DARK GRAY SILT WITH SAND, ORGANIC
		SS2	2'-4'	3"	9	9	12	12		4'	MATTER. STIFF. (ML) (11-65)
		SS3	4'-6'	8"	16	23	30	100 /5"			RUSTY BROWN SILTY F-M SAND, TRACE TO
		SS4	6'-8'	4"	87	100	/5"				SOME GRAVEL,
10		SS5	8'-10'	5"	80	92	96	100 /2"			COBBLES. (SM) (6-65)
		SS6	10'-12'	3"	100	/4"					
										15'	
		SS7	15'-17'	3"	75	100	/1"				GREENISH GRAY SILTY F-C SAND, LITTLE TO
		SS8	17'-19'	5"	32	44	46	50			SOME GRAVEL, COBBLES, BOULDERS.
20		SS9	19'-21'	8"	45	42	40	38			VERY DENSE. TILL MATERIAL.
	SS	10	21'-23'	10"	45	52	55	72			(SM AND GM) (6-65)
										23'	
		R1	23'-29'	92%	REC						GNEISS. MEDIUM GRAY. STEEP FOLIATION(60 DEGREE TO SUBVERTICAL). OXIDATION ON JOINTS TO 60.5'.
30				25%	RQD						
											FROM 23' TO 36.5', SOFT TO MEDIUM HARD, OXIDIZED, FRACTURED FROM 23' TO 28'. A SUB-VERTICAL FOLIATION JOINT FROM 31' TO 32', SMOOTH,
		R2	29'-39'	98%	REC						
40				68%	RQD						OXIDIZED, TIGHT,

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B48-99
LINE & STA. N:322,750.80
OFFSET E:625,279.85

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE. START: 1-28-99
DATE. FINISH: 2-1-99

GROUND ELEVATION 179.30
GROUND WATER ELEVATION 171.05 2/1/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											WITH A 10-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, ROUGH. (4-65/3-65)
		R3	39'-43'	93% REC 52% RQD							MODERATELY CLOSE JOINT SPACING FROM 36.5' TO 38'. CLOSELY JOINTED FROM 38' TO 59' AND BELOW 63'. SUBVERTICAL FOLIATION JOINT, IRREGULAR, CURVED, SMOOTH, CHLORITE, ALTERATION, TIGHT. FROM 36.2' TO 37'. FROM 43' TO 48', FIVE SUBVERTICAL FOLIATION JOINTS, SMOOTH, OXIDIZED, OPEN, WITH SIX 10 TO 20-DEGREE JOINTS ACROSS FOLIATION, OXIDIZED, OPEN. FROM 51.5' TO 53.4', CLOSELY JOINTED WITH SUBVERTICAL FOLIATION JOINTS, SMOOTH, OXIDIZED, OPEN, WITH FOUR 5-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OXIDIZED, OPEN. AT 55.5' TWO 60-DEGREE FOLIATION JOINTS, SMOOTH, OXIDIZED, TIGHT.
50											
10		R4	43'-51'	70% REC 30% RQD							
		R5	51'-56'	96% REC 50% RQD							
MO											
20		R6	56'-60'	56% REC 37% RQD							
		R7	60'-66'	94% REC 55% RQD							
70											
30		R8	66'-70'	98% REC 45% RQD						70'	
N											
80											
40											

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B48-99
LINE & STA N:322,750.80
OFFSET E:625,279.85

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 1-28-99
DATE. FINISH: 2-1-99

GROUND ELEVATION 179.30
GROUND WATER ELEVATION 171.05 2/1/99

CASING O.D HW I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											ROCK QUALITY IMPROVES FROM 59' TO 63' WITH MODERATELY CLOSE JOINT SPACING. (3-65/2-65) ROCK CLASS FROM 36.5' TO 63'.
10											BELOW 63', ROCK IS CLOSELY JOINTED. (3-65) FROM 63.5' TO 64.5', SIX SMOOTH 50-DEGREE FOLIATION JOINTS, TIGHT. FROM 66' TO 66.9', A 60-DEGREE FOLIATION JOINT, SMOOTH, TIGHT WITH ONE 50-DEGREE JOINT ACROSS FOLIATION, SMOOTH, OPEN. FROM 68.25' TO 69', AN 80-DEGREE JOINT ACROSS FOLIATION, IRREGULAR, ROUGH, TIGHT.
20											
30											END OF HOLE 70'
40											

Soil Engineer: _____ Driller: CESAR MORIERA

Drilling Inspector: _____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B49-99
LINE & STA. N:322,798.68
OFFSET E:624,883.11

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE. START: 2-10-99
DATE. FINISH: 2-11-99

GROUND. ELEVATION 194.48
GROUND WATER ELEVATION 179.51 2/15/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	14"	1	1	2	2		0'-2'	TOPSOIL (6"). DARK BROWN SILTY FINE SAND, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-4'	16"	2	2	2	4			
		SS3	4'-6'	15"	5	7	12	14			RUSTY BROWN SILTY FINE SAND, TRACE TO LITTLE GRAVEL FROM 8' TO 20'; WITH SOME GRAVEL BELOW 20'.
		SS4	6'-8'	12"	17	18	20	22			
10		SS5	8'-10'	16"	21	19	20	21			MEDIUM DENSE TO DENSE. (SM AND GP) (6-65)
		SS6	15'-16'	6"	57	100	/6"				
20		SS7	20'-22'	12"	29	44	47	56			
		SS8	25'-26'	8"	49	100	/5"			25'	YELLOW BROWN SILTY F-M SAND, MICA, ROCK FRAGMENTS (GNEISS), COBBLES AND BOULDERS. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK) (SM AND GM) (6-65/5-65)
30		SS9	30'-30.5'	3"	100	/5"					
		R1	34'-36'	96%	REC					34'	GNEISS. MEDIUM GRAY. QUARTZITIC FROM 34' TO 56'. SEVERAL QUARTZITIC BANDS
				56%	RQD						
		R2	36'-37'	66%	REC						
40				0%	RQD						

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO MG-B49-99
LINE & STA N:322,798.68
OFFSET E:624,883.11

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-10-99
DATE. FINISH: 2-11-99

GROUND ELEVATION 194.48
GROUND WATER ELEVATION 179.51 2/15/99

CASING O.D HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											BELOW 60'. FOLIATION IN-
40											DISTINCT FROM 34'
											TO 55' AND BELOW
		R3	37'-45'	93% REC							66'.
				81% RQD							FROM 55' TO 66',
50											FOLIATION AT 30 TO
10											50 DEGREES.
											OXIDATION ON JOINTS
											TO 44'.
		R4	45'-55'	97% REC							FROM 34' TO 37',
				88% RQD							ROCK IS WEATHERED,
60											OXIDIZED, FRACTUREI
20											AND SOFT FROM 36'
											TO 37'.
											(3-65/4-65)
		R5	55'-65'	99% REC							ROCK QUALITY IM-
				76% RQD							PROVES FROM 37' TO
70											59', 67' TO 75',
30											WHERE ROCK IS
											MODERATELY JOINTED.
											AT 54' AND 55.8',
											TWO SUBVERTICAL
											JOINTS WITH FOLIA-
											TION TREND, SMOOTH
											AND 5-DEGREE JOINTS
											ACROSS FOLIATION,
											SMOOTH. (2-65)
		R6	65'-75'	99% REC							ROCK IS CLOSELY
				84% RQD							JOINTED FROM 59'
											TO 67'. (3-65)
										75'	
80											END OF HOLE 75'
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B50-99
LINE & STA. N:322,846.45
OFFSET E:624,486.32

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE. START: 2-12-99
DATE. FINISH: 2-15-99

GROUND ELEVATION 193.62
GROUND WATER ELEVATION 186.25 3/24/99

CASING O.D. HW I.D _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET.	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	0'-2'	14"	1	1	1	1		0'-2'	TOPSOIL (3"). DARK BROWN SILTY SAND, ORGANIC MATTER. LOOSE. (SM) (11-65)
	SS2	2'-4'	18"	5	7	12	20			
	SS3	4'-5.2'	5"	32	40	100	/3"		7'	RUSTY BROWN SILTY FINE SAND, TRACE TO SOME GRAVEL. DENSE TO VERY DENSE. (SM) (6-65)
	R1	7'-15'	89% REC 58% RQD							GNEISS. LIGHT GRAY, MODERATELY HARD TO HARD. FOLIATION AT 40 TO 80 DEGREES. OXIDATION ON JOINTS TO 52'. FROM 7' TO 9.5'. ROCK IS FRACTURED, OXIDIZED ON JOINTS, MODERATELY WEATHERED. AT 10.25', TWO 45-DEGREE JOINTS WITH FOLIATION TREND, HALF INCH APART, SMOOTH, OXIDATION. (4-65/3-65)
	R2	15'-25'	100 % REC 93% RQD							
	R3	25'-35'	100 % REC 85% RQD							

Soil Engineer: _____ Driller: GREG MARNEY

Drilling Inspector: _____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B50-99
LINE & STA. N:322,846.45
OFFSET E:624,486.32

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-12-99
DATE. FINISH: 2-15-99

GROUND ELEVATION 193.62
GROUND WATER ELEVATION 186.25 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											ROCK QUALITY IMPROVES BELOW 9.5'. MODERATELY CLOSE JOINT SPACING EXCEPT FROM 45' TO 55' WHERE ROCK IS CLOSELY JOINTED. FROM 45.7' TO 46.5', TWO JOINTS (50 AND 70 DEGREES) INTERSECTING EACH OTHER, OXIDIZED. A 70-DEGREE FOLIATION JOINT, SMOOTH, OXIDIZED, FROM 46.5' TO 47'. AT 71' AND 76', TWO 50-DEGREE JOINTS ACROSS FOLIATION, ROUGH, ALTERED IN CHLORITE. AT 79.5', A 70-DEGREE JOINT ACROSS FOLIATION, ROUGH, ALTERED IN CHLORITE. (1-65/2-65)
		R4	35'-45'	98% REC 93% RQD							
50											
10											
		R5	45'-55'	100 % REC 78% RQD S							
60											
20											
		R6	55'-65'	100 % REC 100 % RQD							
70											
30											
		R7	65'-75'	100 % REC 96% RQD							PIEZOMETER INSTALLED AT 70'.
80		R8	75'-80'	100 % REC 88% RQD						80'	END OF HOLE 80'
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO. MG-B51-99
LINE & STA. N:323,583.36
OFFSET E:625,500.11

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE, START: 3-17-99
DATE, FINISH: 3-18-99

GROUND ELEVATION 166.78
GROUND WATER ELEVATION 164.21 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	TOPSOIL (4"). DARK BROWN SILTY FINE SAND, ORGANIC MATTER, TRACE GRAVEL. LOOSE. (SM) (11-65)
		SS1	1'-3'	6"	3	6	4	4		3'	
		SS2	4'-6'	12"	4	6	5	8		6'	TAN BROWN SILTY FINE SAND. MEDIUM DENSE. (SM) (7-65)
		SS3	7'-9'	6"	12	14	31	30			
10											GREENISH GRAY SILTY SAND, TRACE GRAVEL,
		SS4	10'-12'	NR	20	17	12	14		13'	DENSE. (SM) (7-65)
		SS5	13'-15'	14"	17	20	31	41			YELLOW/ORANGE BROWN TO DARK GRAY SILTY F-M SAND, TRACE
		SS6	16'-16.2'	4"	100	/3"				17'	GRAVEL, MICA, ROCK FRAGMENTS. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65)
20											
		R1	17'-22'	75% REC						22'	GNEISS. LIGHT GRAY, HARD, WEATHERED. FOLIATION AT 70 DEGREES TO SUBVERT-ICAL. ONE HORIZON-TAL JOINT, OXIDIZED, ROUGH. DRILLING ROD DROPP-ED RAPIDLY FROM 21' TO 21.5' OF DEPTH. GENERALLY MASSIVE. (2-65)
				75% ROD							
30											
											END OF HOLE 22' PERMEABILITY TESTS IN SOIL. MONITORING WELL INSTALLED AT 16'.
40											

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99244

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO. MG-B52-99
LINE & STA. N:324006.96
OFFSET E:625455.73

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 7-23-99
DATE. FINISH: 7-24-99

GROUND ELEVATION 163.71
GROUND WATER ELEVATION 160.57 7/28/99

CASING O.D. HX I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE ____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
									0'-	TOPSOIL/HUMUS(10")
	SS1	1'-3'	1"	3	3	3	3		3'	GRAY SILT WITH FINE SAND, SOFT (ML) (11-65)
	SS2	4'-6'	20"	4	3	3	5		6'	GRAY TO TAN BROWN SILTY FINE SAND, LOOSE, TRACE MICA, (SM) (7-65)
	SS3	7'-9'	18"	10	6	12	40		10'	GRAY FINE SAND, WITH SOME SILT, TRACE GRAVEL, MICA, MEDIUM DENSE TO DENSE. (SM) (7-65)
	SS4	10'-12'	6"	2	1	2	3			
	SS5	13'-15'	8"	5	3	11	20		16'	YELLOW BROWN SILTY FINE TO MEDIUM SAND, TRACE GRAVEL, MICA, ROCK FRAGMENTS, MEDIUM DENSE TO DENSE. (SM AND GM) (6-65)
	SS6	16'	0"	100	/0"					
										END OF HOLE 16'
										PERMEABILITY TESTS IN SOIL.
										MONITORING WELL INSTALLED AT 16'.

Soil Engineer: ____ Driller: SAL LAURENZA

Drilling Inspector: ____ Helper: JOHN OLMO

JOB LOCATION:

MOSHLOU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99244

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO. MG-B53-99
LINE & STA. N:324340.42
OFFSET E:625139.18

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE, START: 7-27-99
DATE, FINISH: 7-27-99

GROUND ELEVATION 174.56
GROUND WATER ELEVATION 168.59 7/28/99

CASING O.D. HX I.D. -
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE ____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
									0'-	TOPSOIL/HUMUS (8") YELLOW BROWN TO BROWN SILTY FINE SAND, TRACE GRAVEL, MOTTLED, LOOSE TO
	SS1	1'-3'	18"	2	3	3	3			
	SS2	4'-6'	16"	7	17	24	31		6'	DENSE. (SM) (7-65)
	SS3	7'-9'	8"	24	24	17	17		9.5'	YELLOW BROWN SILTY FINE TO MEDIUM SAND, TRACE GRAVEL, MICA, ROCK FRAGMENTS, DENSE. (SM AND GM) (6-65)
	SS4	9.5'	0"	100	/2"					
										END OF HOLE 9.5'
										PERMEABILITY TESTS IN SOIL.
										MONITORING WELL INSTALLED AT 9.5'.

Soil Engineer: ____ Driller: SAL LAURENZA

Drilling Inspector: ____ Helper: JOHN OLMO

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99244

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO. MG-B54-99
LINE & STA. N:323722.17
OFFSET E:625513.99

DEPTH _____ FT. ____ FT. CASING OUT DATE: _____
DEPTH _____ FT. ALL CASING OUT DATE: _____

DATE, START: 7-21-99
DATE, FINISH: 7-22-99

GROUND ELEVATION 163.65
GROUND WATER ELEVATION 158.70 7/28/99

CASING O.D. HX I.D. _____
SAMPLER O.D. 2" I.D. _____
DIAMOND BIT SIZE _____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
	SS1	1'-3'	18"	6	4	4	8		0'-	TOPSOIL/HUMUS/ROOTS (12"). TAN BROWN SILTY FINE TO
									4'	MEDIUM SAND, TRACE MICA, LOOSE. (SM) (7-65)
	SS2	4'-6'	20"	3	3	7	9			
	SS3	7'-9'	18"	7	7	8	8			GREENISH BROWN GRAY SILTY FINE SAND, TRACE GRAVEL, MEDIUM DENSE. (SM) (7-65)
	SS4	10'-12'	18"	7	10	12	14		12'	
	SS5	14'-16'	16"	20	80	80	91			YELLOW BROWN TO BROWN SILTY FINE TO MEDIUM SAND, TRACE GRAVEL, MICA, ROCK
	SS6	16'	0"	100	/0"				16'	FRAGMENTS, DENSE. (SM AND GM) (6-65)
										END OF HOLE 16'
										PERMEABILITY TESTS IN SOIL.
										MONITORING WELL INSTALLED AT 15.5'.

0
10
20
30
40

Soil Engineer: _____ Driller: SAL LAURENZA

Drilling Inspector: _____ Helper: JOHN OLMO

JOB LOCATION:
MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99244

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO. MG-B55-99
LINE & STA. N:323616.50
OFFSET E:624554.67

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 7-20-99
DATE. FINISH: 7-21-99

GROUND ELEVATION 187.85
GROUND WATER ELEVATION 178.61 7/28/99

CASING O.D. HX I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE ____

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										0'-	
		SS1	1'-3'	18"	7	8	8	8			TOPSOIL (8"). TAN BROWN TO GRAY SILTY FINE SAND, TRACE FINE GRAVEL, MICA.
		SS2	4'-6'	20"	10	10	13	20		6'	MEDIUM DENSE. (SM) (7-65)
		SS3	7'-9'	18"	18	14	15	18		10.	YELLOW BROWN TO BROWN SILTY FINE TO
10		SS5	10'-10.75'	4"	21	100	/3"			75'	MEDIUM SAND, TRACE GRAVEL, MICA, ROCK FRAGMENTS, DENSE. (SM AND GM) (6-65)
											END OF HOLE 10.75'
											PERMEABILITY TESTS IN SOIL.
											MONITORING WELL INSTALLED AT 10'.
20											
30											
40											

Soil Engineer: ____ Driller: SAL LAURENZA

Drilling Inspector: ____ Helper: JOHN OLMO

APPENDIX B

AIR TRACK BORING DATA

THIS PAGE INTENTIONALLY LEFT BLANK

AIR TRACK BORINGS

AIR TRACK NO.	NORTHING	EASTING	ELEVATION	DEPTH TO ROCK	ROCK ELEVATION
AT-1-99	323,231.34	625,305.43	177.08	15.0	162.1
AT-2-99	323,287.15	625,125.73	180.82	14.0	166.8
AT-3-99	323,338.53	624,960.29	184.97	12.0	173.0
AT-4-99	323,317.85	624,836.76	189.79	4.0	185.8
AT-5-99	323,367.50	624,683.17	192.19	3.0	189.2
AT-6-99	323,359.03	624,565.00	193.65	7.0	186.7
AT-7-99	323,184.34	624,516.58	196.16	6.5	189.7
AT-8-99	322,987.27	624,510.54	195.61	6.0	189.6
AT-9-99	322,970.92	624,634.44	196.32	12.0	184.3
AT-10-99	323,198.40	624,720.01	193.80	4.0	189.8
AT-11-99	322,933.85	624,896.02	195.69	30.0	165.7
AT-12-99	323,110.38	624,965.17	192.19	11.0	181.2
AT-13-99	322,959.60	624,999.33	195.74	31.0	164.7
AT-14-99	323,095.14	625,134.66	183.81	13.0	170.8
AT-15-99	322,948.07	625,239.02	178.66	21.5	157.2
AT-16-99	323,273.77	625,244.18	178.58	13.0	165.6
AT-17-99	323,086.88	624,347.88	194.96	14.5	180.5
AT-18-99	323,262.25	624,412.03	198.80	4.0	194.8
AT-19-99	323,142.66	624,281.03	195.30	12.0	183.3
AT-20-99	322,812.53	624,821.34	193.08	36.0	157.1
AT-21-99	322,794.33	624,710.90	193.51	10.0	183.5
AT-22-99	322,841.98	624,912.32	196.62	44.0	152.6
AT-23-99	322,838.48	624,984.86	197.17	40.0	157.2
AT-24-99	323,001.44	624,401.01	194.23	5.0	189.2
AT-25-99	323,236.84	624,710.91	194.27	4.5	189.8
AT-26-99	322,964.98	624,719.76	195.63	13.0	182.6
AT-27-99	323,044.78	624,845.92	193.96	21.5	172.5
AT-28-99	323,248.76	624,911.78	189.30	21.0	168.3
AT-29-99	323,230.39	625,061.33	187.08	18.0	169.1
AT-30-99	322,952.81	625,064.00	189.82	22.0	167.8
AT-31-99	322,974.08	625,306.95	176.98	20.0	157.0
AT-32-99	322,971.13	624,796.17	195.22	17.0	178.2
AT-33-99	322,779.92	625,062.84	192.43	31.0	161.4
AT-34-99	322,766.35	624,936.30	197.30	38.0	159.3
AT-35-99	322,755.93	624,834.52	193.12	33.0	160.1

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX C

TEST PIT LOGS

THIS PAGE INTENTIONALLY LEFT BLANK

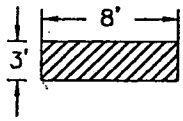
TEST PIT FIELD LOG

Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP1-99 FILE No. MGTP199.DWG DATE 9 Mar. 99
ENGINEER R. Kantor WEATHER 30° F, Sunny	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 181.36 TIME STARTED 0815 3/9/99 TIME COMPLETED 0900 3/9/99

DEPTH	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
0	Top 6" Topsoil	E	2/A	
1'	3' Wide	E	1/A 2/B	
2'	Brown-tan F-C sand, some silt, little to tr. cobbles and boulders, moist to wet (SM) (6-65)	E	1/C	
3'		E	3/A	
4'		E	2/A	
5'		E	3/A	
6'	Water at 6.5' ▽	D	6/A	Saprolitic
7'	Brown-tan silty F-M sand, some gravel, mica, rock fragments, possible saprolitic soil (SM/GM) (6-65/5-65)			
8'	Bottom of excavation 7.5 feet Sample taken at 7.5 feet			
9'	Approximate vertical walls			
10'				
11'				
12'				
13'				
14'				

REMARKS:

TEST PIT PLAN



VOLUME= 6.67 cu.yd.

LEGEND:

BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT

E ____ EASY
M ____ MODERATE
D ____ DIFFICULT

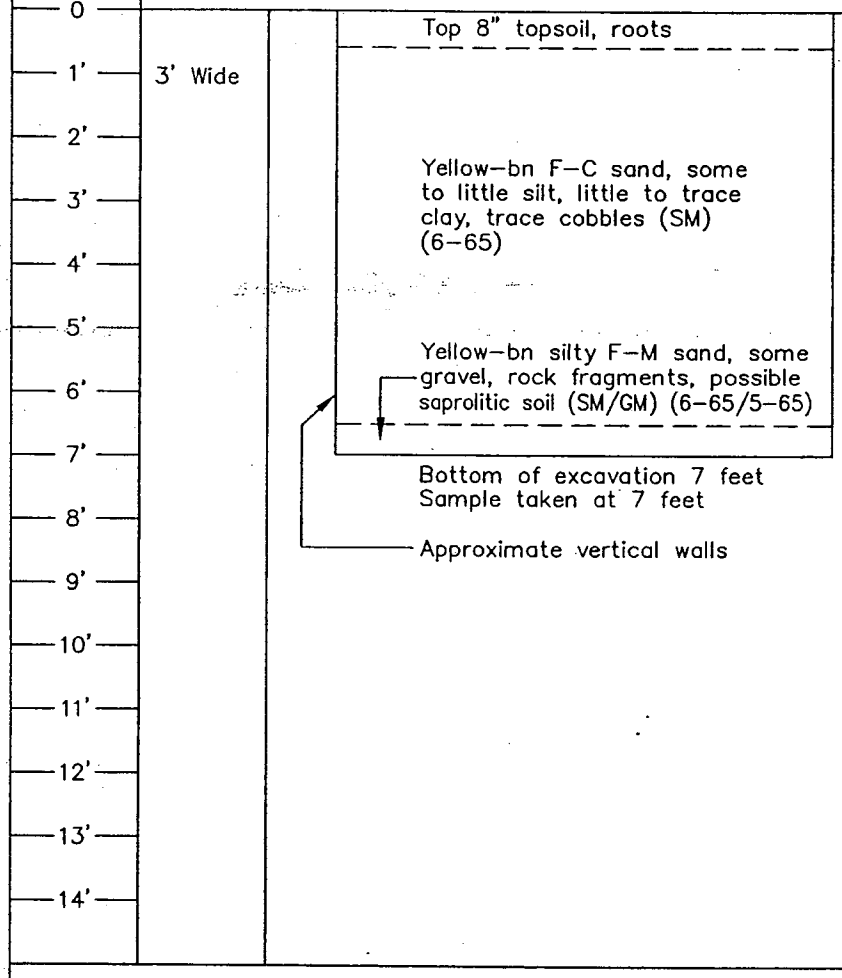
GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

P:\1303NY\MGTP199.DWG

TEST PIT FIELD LOG

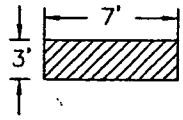
Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP2-99 FILE No. MGTP299.DWG DATE 9 Mar. 99
ENGINEER R. Kantor WEATHER 30° F, Sunny	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 194.84 TIME STARTED 0915 3/9/99 TIME COMPLETED 1030 3/9/99



EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
E		
E	4/A	
E	2/A	
M		
M		
M		
D	6/A 1/B	Saprolitic

REMARKS: Groundwater not encountered

TEST PIT PLAN



VOLUME= 5.4 cu.yd.

P:\1303NY\MGTP299.DWG

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

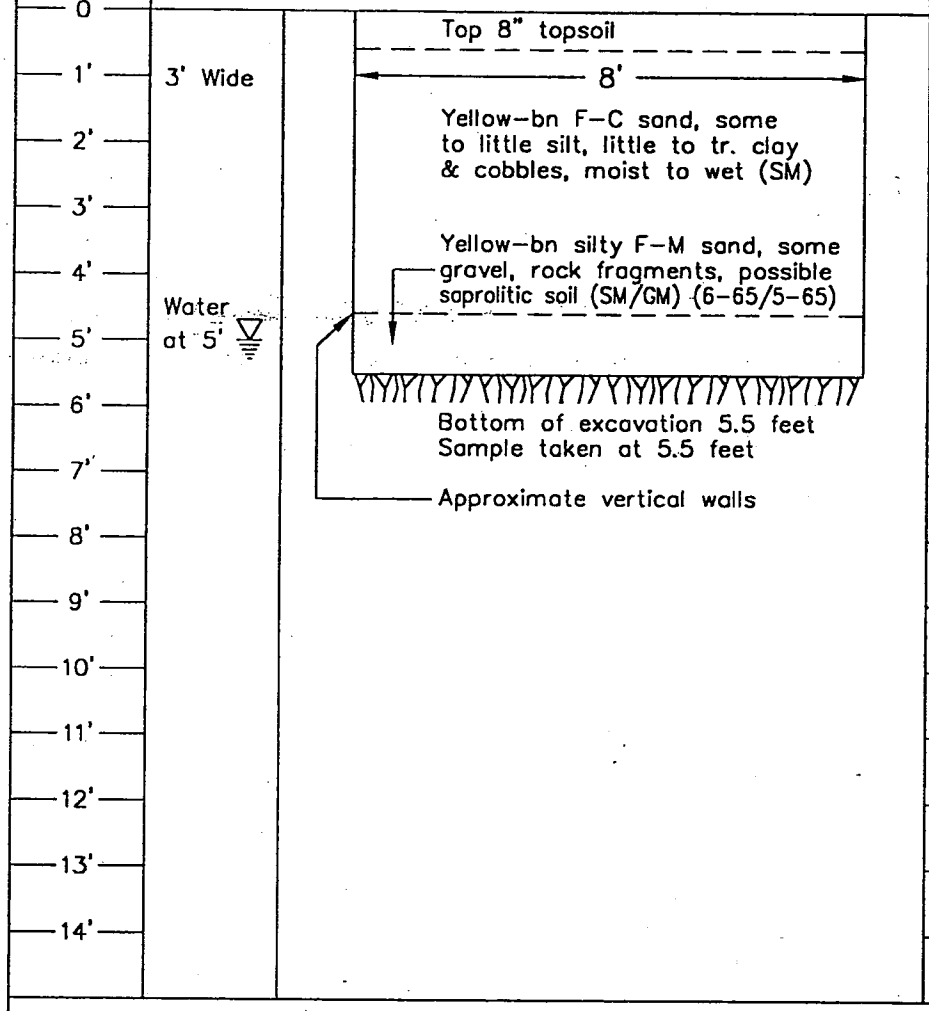
F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT
E EASY
M MODERATE
D DIFFICULT
GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

TEST PIT FIELD LOG

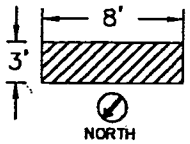
Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP3-99 FILE No. MGTP399.DWG DATE 9 Mar. 99
ENGINEER R. Kantor WEATHER 35° F, Sunny	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 187.07 TIME STARTED 1215 3/9/99 TIME COMPLETED 1300 3/9/99 N: 320353 E: 621806



EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
E	5/A	
M	1/A	
M		
M		
M/D	3/A 7/A	
D	6/A 1/B	Saprolitic
		Excavation refusal due to bedrock
		@ 5.5'

REMARKS:
1. Reservoir slab sawcut prior to excavation
2. TP-5 along perimeter wall.

TEST PIT PLAN



VOLUME= 4.89 cu.yd.

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

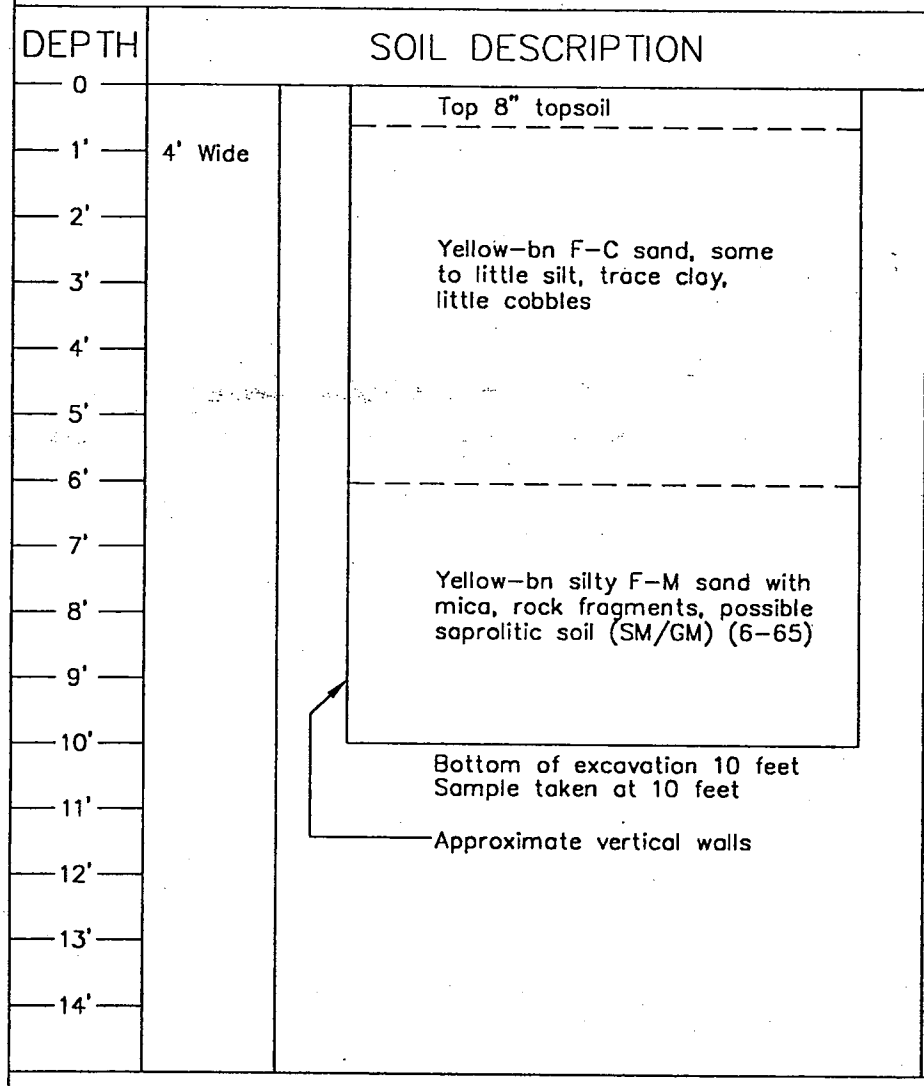
EXCAVATION EFFORT
E EASY
M MODERATE
D DIFFICULT

GROUNDWATER
ELAPSED TIME TO READING G.W. (HRS.)
No Groundwater

P:\13032NY\MGTP399.DWG

TEST PIT FIELD LOG

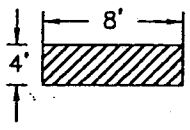
Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP4-99 FILE No. MGTP499.DWG DATE 9 Mar. 99
ENGINEER R. Kantor WEATHER 38° F, M. Cloudy	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 197.02 TIME STARTED 1350 3/9/99 TIME COMPLETED 1500 3/9/99



EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
E	4/A	
E	6/A	
M	3/A 2/B	
M	5/A 3/B	
M	6/A 2/B	
M	10/A 4/B	
M	8/A 4/B	Saprolitic
M	11/A 3/B	
D	10/A 3/B	
D	9/A 2/B	

REMARKS: Groundwater not encountered

TEST PIT PLAN



VOLUME= 11.85 cu.yd.

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT

E ____ EASY
M ____ MODERATE
D ____ DIFFICULT

GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

P:\13032NY\MGTP499.DWG

TEST PIT FIELD LOG

Warren George, Inc.
Foot of Jersey Ave.
Jersey City, NJ 07303

PROJECT
DESCRIPTION Mosholu GC
LOCATION Bronx, NY

TEST PIT No. MG-TP5-99
FILE No. MGTP599.DWG
DATE 10 Mar. 99

ENGINEER Kantor

WEATHER 24° F, P. Sunny

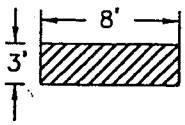
EXCAVATION EQUIPMENT
CONTRACTOR Smith Bros.
OPERATOR John Smith
MAKE Nagano MODEL NS-35
CAPACITY 0.5 cu.yd. REACH 12 ft.

GROUND ELEV. 195.39
TIME STARTED 0815 3/10/99
TIME COMPLETED 1000 3/10/99

DEPTH	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
0	Top 12" topsoil	E		1' topsoil
1'	3' Wide	E		
2'	Yellow-bn F-C sand, some to little silt, little to trace cobbles, trace clay, moist (SM) (6-65)	E		
3'		E	3/A 1/B	
4'		M	7/A 2/B	
5'		M	8/A 2/B	Saprolitic
6'	Yellow-bn silty sand, trace gravel, rock fragments, possible saprolitic soil (SM) (6-65)	D	11/A 3/B	Saprolitic
7'	Bottom of excavation 7 feet Sample taken at 7 feet			
8'	Approximate vertical walls			
9'				
10'				
11'				
12'				
13'				
14'				

REMARKS: Groundwater not encountered

TEST PIT PLAN



VOLUME= 6.22cu.yd.

P:\13032NY\MGTP599.DWG

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT
E_____EASY
M_____MODERATE
D_____DIFFICULT
GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

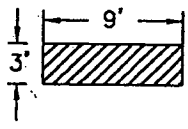
TEST PIT FIELD LOG

Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP6-99 FILE No. MGTP699.DWG DATE 10 Mar. 99
ENGINEER R. Kantor WEATHER 35° F, P. Sunny	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 195.32 TIME STARTED 1015 3/10/99 TIME COMPLETED 1130 3/10/99

DEPTH	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
0	Top 5" topsoil	E		
1'	3' Wide	E		
2'	Yellow-bn F-C sand, some to little silt, trace clay, little to trace cobbles, moist (SM)	E	7/A 1/B	
3'		E	3/A	
4'		E	4/A	
5'		E	4/A	
6'		E	6/A	
7'		M	8/A 1/B	
8'	Yellow-bn silty F-M sand, trace to some gravel, cobbles, possible saprolitic soil (SM) (6-65)	M	12/A 1/B	
9'		D	11/A 1/B	Saprolitic
10'	Bottom of excavation 10 feet Sample taken at 10 feet			
11'	Approximate vertical walls			
12'				
13'				
14'				

REMARKS: Groundwater not encountered

TEST PIT PLAN



VOLUME= 10.00cu.yd.

P:\13032NY\MGTP699.DWG

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

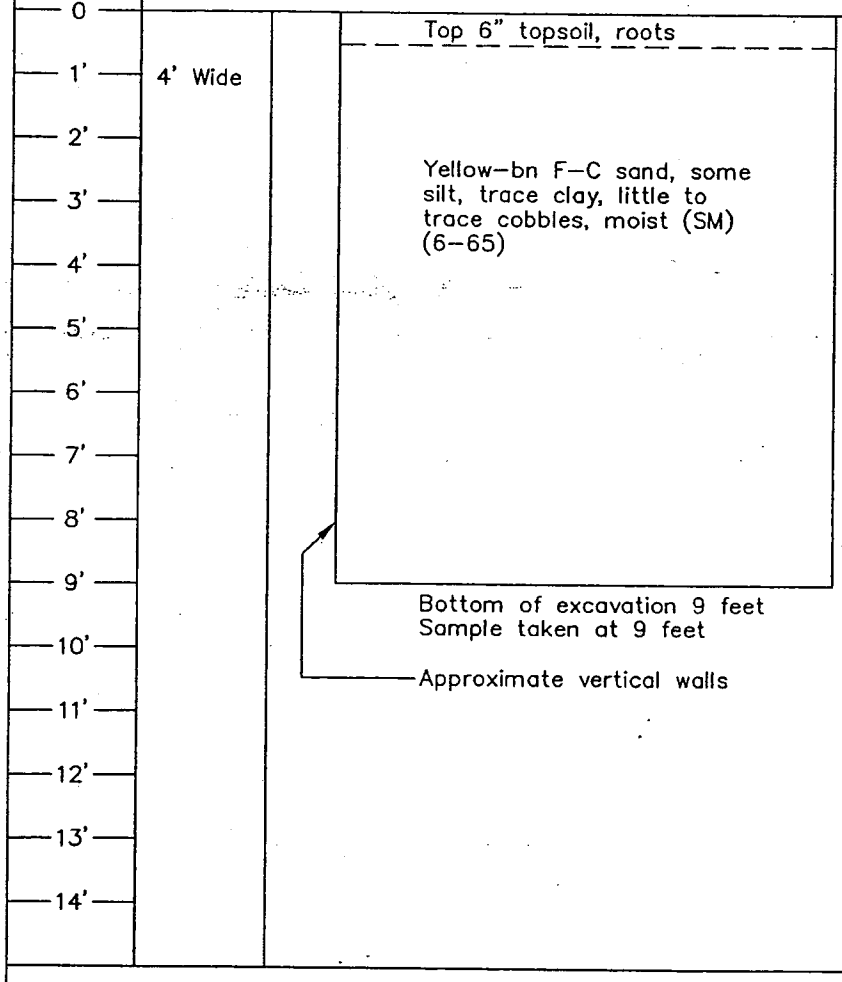
F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT
E_____EASY
M_____MODERATE
D_____DIFFICULT
GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

TEST PIT FIELD LOG

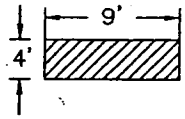
Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP7-99 FILE No. MGTP799.DWG DATE 10 Mar. 99
ENGINEER R. Kantor WEATHER 38° F, M. Sunny	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 192.28 TIME STARTED 1310 3/10/99 TIME COMPLETED 1700 3/10/99



EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
E	2/A 1/C	Lg. boulder just below surface
E	5/A	
E	7/A	
M	11/A 1/B	
M	8/A	
M	7/A	
M	10/A 1/B	
D	12/A 2/B	
D	12/A 3/B	

REMARKS: Groundwater not encountered
Larger quantity of boulders than in previous test pits.

TEST PIT PLAN



VOLUME= 12.00cu.yd.

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT

E EASY
M MODERATE
D DIFFICULT
GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

P:\13032NY\MGTP799.DWG

TEST PIT FIELD LOG

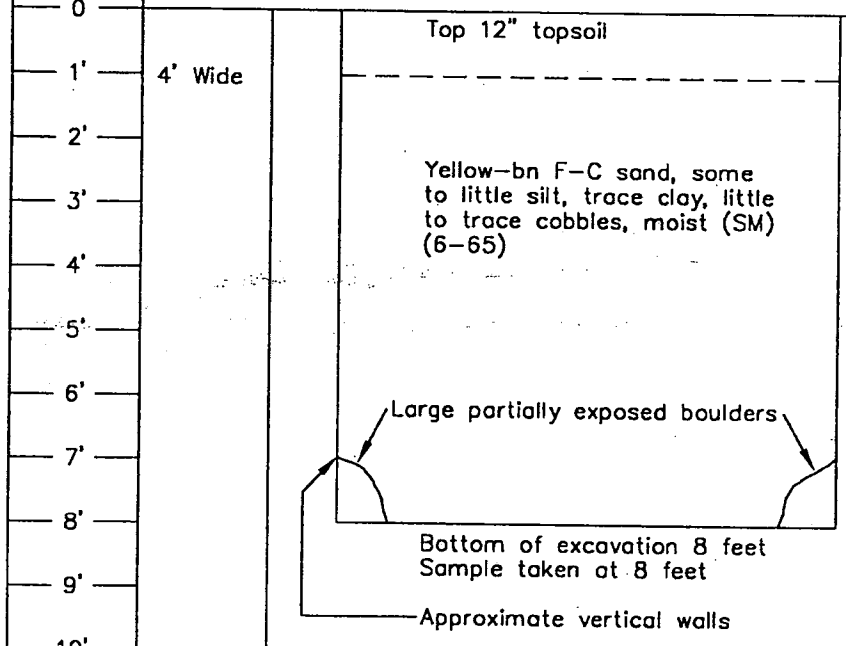
Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP8-99 FILE No. MGTP899.DWG DATE 11 Mar. 99

ENGINEER R. Kantor

WEATHER 30° F, Sunny

EXCAVATION EQUIPMENT
CONTRACTOR Smith Bros.
OPERATOR John Smith
MAKE Nagano MODEL NS-35
CAPACITY 0.5 cu.yd. REACH 12 ft.

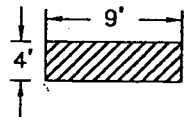
GROUND ELEV. 181.89
TIME STARTED 0800 3/11/99
TIME COMPLETED 0850 3/11/99



SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
Top 12" topsoil	E		
Yellow-bn F-C sand, some to little silt, trace clay, little to trace cobbles, moist (SM) (6-65)	E	2/A	
	E	3/A	
	E	3/A	
	E	4/A	
	M	6/A 1/B	
Large partially exposed boulders	M	5/A 3/B	
	D	7/A 2/B 2/C	2-C boulders on either side of exc.
Bottom of excavation 8 feet Sample taken at 8 feet			
Approximate vertical walls			

REMARKS: Groundwater not encountered

TEST PIT PLAN



VOLUME= 10.67 cu.yd.

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT

E ____ EASY
M ____ MODERATE
D ____ DIFFICULT

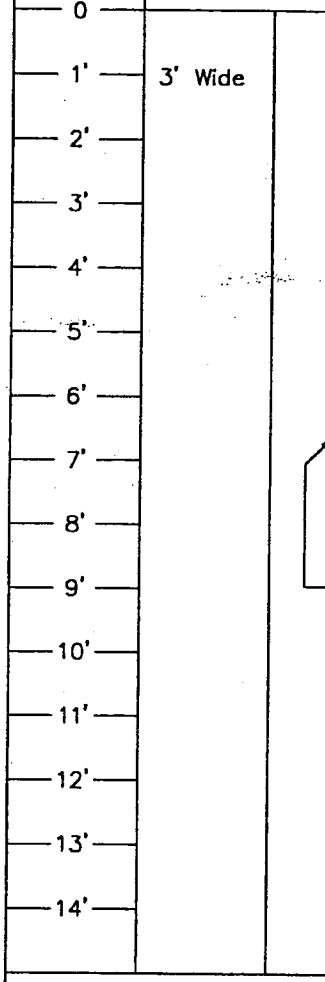
GROUNDWATER

ELAPSED TIME TO READING (HRS.) G.W.

P:\13032NY\MGTP899.DWG

TEST PIT FIELD LOG

Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP9-99 FILE No. MGTP999.DWG DATE 11 Mar. 99
ENGINEER R. Kantor WEATHER 35° F, Sunny	EXCAVATION EQUIPMENT CONTRACTOR Smith Bros. OPERATOR John Smith MAKE Nagano MODEL NS-35 CAPACITY 0.5 cu.yd. REACH 12 ft.	GROUND ELEV. 171.45 TIME STARTED 0910 3/11/99 TIME COMPLETED 1010 3/11/99



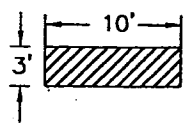
SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
Top 20" topsoil & fill material (11-65) (inc. asphalt, concrete and bricks)	E	3/A 2/B	Larger boulders near surface
	M	5/A 2/B	
Yellow-bn F-C sand and silt, little to trace cobbles, trace clay, damp (SM) (7-65)	M	6/A 2/B	
	E	3/A	Softer digging
	M	5/A	
Yellow-bn silty F-M sand, mica, rock fragments, possible saprolitic soil (6-65/5-65)	D	3/A	Saprolitic
	D	3/A	Saprolitic

Bottom of excavation 7.5 feet
Sample taken at 7.5 feet

Approximate vertical walls

REMARKS: Groundwater not encountered
Dense soil 4' to 7.5'

TEST PIT PLAN



VOLUME= 8.33 cu.yd.

LEGEND:

BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"-18"	A
18"-36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0-10%
LITTLE (LI.) 10-20%
SOME (SO) 20-35%
AND 35-50%

ABBREVIATIONS

F-FINE
M-MEDIUM
C-COARSE
F/M-FINE TO MEDIUM
F/C-FINE TO COARSE
V-VERY
GR.-GRAY
BN.-BROWN
YEL-YELLOW

EXCAVATION EFFORT

E_____EASY
M_____MODERATE
D_____DIFFICULT

GROUNDWATER

ELAPSED TIME TO READING (HRS.) G.W.

P:\13032NY\MGTP999.DWG

TEST PIT FIELD LOG

Warren George, Inc. Foot of Jersey Ave. Jersey City, NJ 07303	PROJECT DESCRIPTION Mosholu GC LOCATION Bronx, NY	TEST PIT No. MG-TP10-99 FILE No. MGTP1099.DWG DATE 11 Mar. 99

ENGINEER R. Kantor

WEATHER 38° F, Sunny

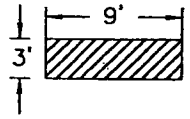
EXCAVATION EQUIPMENT
CONTRACTOR Smith Bros.
OPERATOR John Smith
MAKE Nagano MODEL NS-35
CAPACITY 0.5 cu.yd. REACH 12 ft.

GROUND ELEV. 168.60
TIME STARTED 1030 3/11/99
TIME COMPLETED 1145 3/11/99

DEPTH	SOIL DESCRIPTION	EXCAV. EFFORT	BOULDER COUNT QTY. CLASS	REMARK No.
0	Top 10" topsoil	E		Topsoil
1'	3' Wide Water seeping at 2' ▽	E	6/A	Fill material
2'	10"–5' Brown F–C sand, some to little silt, little to trace cobbles, trace clay, ash, brick fragments, moist to wet (fill)	E	5/A	
3'		E	7/A 1/B	
4'		E	6/A	Gray organic silt dense
5'	5'–7.5' Gray–bn mottled F–C sand, little to trace silt, trace cobbles, trace clay, micaceous, moist to wet (SM) (7–65)	D	5/A 1/B	
6'		D	6/A 1/B 1/C	
7'	Bottom of excavation 7.5 feet Sample taken at 7.5 feet			
8'	Approximate vertical walls Unstable walls at 2–5 feet			
9'				
10'				
11'				
12'				
13'				
14'				

REMARKS:

TEST PIT PLAN



VOLUME= 8.33 cu.yd.

LEGEND:
BOULDER COUNT

SIZE RANGE CLASSIFICATION	LETTER DESIGNATION
6"–18"	A
18"–36"	B
36" and Larger	C

PROPORTIONS USED

TRACE (TR.) 0–10%
LITTLE (LI.) 10–20%
SOME (SO) 20–35%
AND 35–50%

ABBREVIATIONS

F–FINE
M–MEDIUM
C–COARSE
F/M–FINE TO MEDIUM
F/C–FINE TO COARSE
V–VERY
GR.–GRAY
BN.–BROWN
YEL–YELLOW

EXCAVATION EFFORT

E ____ EASY
M ____ MODERATE
D ____ DIFFICULT
GROUNDWATER

ELAPSED TIME TO READING G.W. (HRS.)

P:\13032NY\MGTP1099.DWG

APPENDIX D

ORIENTED CORE MEASUREMENTS

THIS PAGE INTENTIONALLY LEFT BLANK

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core from 110' to 150'

Top of Rock at 11'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-9-99	MG-B2-99	VERT	110' - 110.25'	84.63' - 84.38'	N38°E	Foliation	20°E	N58°E	60°S	Quartzitic
			110.29' - 112.7'	84.34' - 81.93'	N38°E	Joint	30°E	N68°E	10°N	Across Foliation
			111' - 111.5'	83.63' - 83.13'	N38°E	Foliation	20°E	N58°E	60°N	Foliation Changes to Opposite Direction
			111.5' - 117.5'	83.13' - 77.13'	N38°E	Foliation	20°E	N58°E	60°S	Foliation Changes to Original Direction
			117.5' - 120.5'	77.13' - 74.13'	N38°E	Foliation	20°E	N68°E	90°	Vertical Foliation
			118.6'	76.03'	N38°E	Joint	30°E	N68°E	20°S	With Foliation Trend
			120.5'	74.13' - 68.13'	N38°E	Foliation	12°E	N50°E	30°-80°NW	Variable Foliation
			123'	71.63'	N38°E	Joint	62°E	N80°W	30°NE	Across Foliation
			126.5' - 130.5'	68.13' - 64.13'	N38°E	Foliation	10°N	N28°E	70°-80°NW	
			127.5'	67.13'	N38°E	Joint	90°N	N52°W	60°NE	Across Foliation
			128.3'	66.33'	N38°E	Joint	10°N	N28°E	70°NW	Foliation Joint
			130.5' - 144'	64.13' - 50.63'	N38°E	Foliation	10°N	N28°E	70°-85°NW	
			131'	63.63'	N38°E	Joint	30°E	N68°E	10°N	Across Foliation
			133.3', 134.5'	61.33', 60.13'	N38°E	Joint	82°E	N60°E	60°N	Across Foliation (2 Joints)
			133.5'	61.13'	N38°E	Joint	82°E	N60°W	5°N	Across Foliation
			135.1'	59.53'	N38°E	Joint	10°N	N28°E	80°N	Foliation Joint
			137.8'	56.83'	N38°E	Joint	10°N	N28°E	80°N	Foliation Joint

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-9-99	MG-B2-99	VERT	142'	52.63'	N38°E	Joint	60°E	N82°W	40°N	Across Foliation, Epidote, Smooth
			143.75'	50.88'	N38°E	Joint	40°E	N78°E	60°N	With Foliation
			144' - 150'	50.63' - 44.63'	N38°E	Foliation	0°	N38°E	70°N	
			147'	47.63'	N38°E	Joint	50°E	N88°E	30°N	Across Foliation, Epidote

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 65' to 75'

Top of Rock at 13'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-8-99	MG-B5-99	VERT	65'-67'	134.49' - 132.49'	N15°E	Foliation		N65°W	70°S	
			67'	132.49'	Scribe "Jumps" 10°, to N5°E					
			67' – 75'	132.49' - 124.99'	N5°E	Foliation	70°W	N65°W	60°-70°S	
			68.5'	130.99'	N5°E	Joint	80°E	N85°E	20°N	Across Foliation
			67.9'	131.59'	N5°E	Joint	30°W	N25°W	20°N	Across Foliation
			70'	129.49	N5°E	Joint	0	N5°E	30°N	Across Foliation
			70.75', 71.9'	128.74', 127.59'	N5°E	Joint	65°W	N60°W	20°S	With Foliation (2 Joints)
			72.3'	127.19	N5°E	Joint	65°E	N70°E	50°N	Across Foliation
			68.9'	130.59'	N5°E	Joint	80°W	N85°W	20°N	Across Foliation

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 14' to 74'

Top of Rock 4'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-2-99	MG-B17-99	VERT	15.3'	177.03'	N80°E	Joint	0°	N80°E	60°S	Across Foliation, Oxidation
			16.25'	176.08'	N80°E	Joint	0°	N80°E	60°S	Across Foliation, Chlorite
			17.5'	174.83'	N80°E	Joint	40°N	N40°E	30°N	Across Foliation, Epidote on Surface
			14' - 18'	178.33' - 174.33'	N80°E	Foliation	80°E	N20°W	65°E	Strike Changes Slightly in Quartzite Band at 18'
			18' - 20'	174.33' - 172.33'	N80°E	Foliation	90°	N10°W	40°E	
			18'	174.33'	N80°E	Joint	90°	N10°W	50°E	With Foliation Trend
			19' - 24'	173.33' - 168.33'	N80°E	Foliation	80°N	N	40°E	
			24.9'	167.43'	N80°E	Joint	70°N	N20°E	50°S	Foliation Joint, Slight Oxidation
			24' - 26'	168.33' - 166.33'	FOLIATION INDISTINGUISHABLE					
			25'	167.33'	N80°E	Joint	70°N	N10°W	40°S	With Foliation Trend
			26' - 42'	166.33' - 150.33'	N80°E	Foliation	40°E	N60°W	30°N - 70°N	
			41.7'	150.63'	N80°E	Joint	80°N	N	30°E	
			42' - 52'	166.33' - 140.33'	FOLIATION INDISTINGUISHABLE					Quartzite Zone
			44' - 50.5'	148.33' - 141.83'	NO ORIENTATION SCRIBE SPUN					
			49.3'	143.03'	N80°E	Joint	50°E	N50°W	10°N	Within Quartzite Zone
			52' - 70.5'	140.33' - 121.83'	N80°E	Foliation	40°E	N60°W	50°N - 80°N	
			51.5'	140.83'	N80°E	Joint	80°N	N	50°S	With Foliation Trend

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-2-99	MG-B17-99	VERT	52'	140.33'	N80°E	Joint	80°N	N	10°E	
			67'	125.33'	N80°E	Joint	40°E	N60°W	50°N	Foliation Joint
			70.5 - 74.0'	121.83' - 118.33'	FOLIATION INDISTINGUISHABLE					Quartzite Zone

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 20' to 80'

Top of Rock at 15'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-8-99	MG-B18-99	VERT	20' – 30'	174.72' - 164.72'	N5°E	Foliation	35°W	N30°W	70°N	
			20.6'	174.12'	N5°E	Joint	35°W	N30°W	70°N	Dip tends to North
			30' – 40'	164.72' - 154.72'	NO ORIENTATION SCRIBE SPUN					
			42.1'	152.62'	N5°E	Joint	35°W	N30°W	40°S	Foliation Joint, Epidote
			40' – 49'	154.72' - 145.72'	N5°E	Foliation	35°W	N30°W	40° - 60° S	Foliation Joint
			49' – 51.5'	145.72' - 143.22'	FOLIATION INDISTINGUISHABLE					Quartzitic Zone
			51.5'	143.22'	N5°E	Joint	80°E	N85°E	60°S	Foliation Joint
			52.0' - 55.5'	142.72' - 139.22'	N5°E	Foliation	45°W	N40°W	60°N	Foliation Change
			54.7'	140.02'	N5°E	Foliation Joint	45°W	N40°W	50°S	Foliation Change at 53.5'
			55.5' - 60.5'	139.22' - 134.22'	N5°E	Foliation	65°W	N60°W	30° - 50°S	
			59.7'	135.02'	N5°E	Joint	0°	N5°E	80° - 40°N	Across Foliation
			60.5' - 67.0'	134.22' - 127.72'	FOLIATION INDISTINGUISHABLE					
			67.0' - 69.5'	127.72' - 125.22'	N5°E	Foliation	75°W	N70°W	50° - 70°N	Foliation Change at 67'
			68.3', 69.5'	126.42', 125.22'	N5°E	Joint	75°W	N70°W	70°N	Foliation Joint (2 Joints)
			69.5' - 75.0'	125.22' - 119.72'	FOLIATION INDISTINGUISHABLE					Quartzitic Zone

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-8-99	MG-B18-99	VERT	75.5' - 77'	119.22' - 117.72'	FOLIATION INDISTINGUISHABLE					
			77' – 80'	117.72' - 114.72'	N5°E	Foliation	45°W	N40°W	70°N	

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 45' to 65'

Top of Rock 10'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
3-11-99	MG-B29-99	VERT	45' - 47.5'	136.72' - 134.22'	N	Foliation	0°	N	40°W	
			47.5'	134.22'	N	Foliation Joint	5°W	N5°W	60°W	Mica
			47.5' - 50'	134.22' - 131.72'	N	Foliation	10°W	N10°W	60°W	
			50' - 50.5'	131.72' - 131.22'	N	Joint	10°E	N10°E	70°E	Across Foliation, Pyritic, Epidote
			50.8'	130.92'	N	Foliation Joint	20°W	N20°W	60°W	Schist, Epidote
			50' - 53'	131.72' - 128.72'	N	Foliation	20°E	N20°E	50° - 60°W	
			51.1', 51.3'	130.62', 130.42'	N	Foliation Joints	20°W	N20°W	30°W	Epidote, Pyritic
			53' - 54'	128.72' - 127.72'	FOLIATION INDISTINGUISHABLE					Quartzite Zone
			54' - 59.5'	127.72' - 122.22'	N	Foliation	30° - 40°W	N30° to N40°W	45° - 60°SW	
			59.5' - 63'	122.22' - 118.72'	N	Foliation	NO APPARENT STRIKE – DIP (HORIZONTAL)			
			63' - 65'	118.72' - 116.72'	N	Foliation	60°W	N60°W	65°SW	
			64'	117.72'	N	Joint	80°W	N80°W	20°S	
			64.9'	116.82'	N	Joint	80°W	N80°W	30°S	

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 45' to 65'

Top of Rock 10'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
2-17-99	MG-B30-99	VERT	30.5' - 40'	163.37' - 153.87'	SCRIBE MARKS UNREADABLE					
			40' - 42.5'	153.87' - 151.37'	N80°W	Foliation	25°	N75°E	80°S	
			40.8'	153.07'	N80°W	Joint	90°	N10°E	50°N	Across Foliation
			42.5' - 46'	151.37' - 147.87'	N80°W	Foliation	10°	N90°W	70°S	
			46' - 47'	147.87' - 146.87'	N80°W	Foliation	0°	N80°W	60°N	Foliation Changes
			47' - 48'	146.8' - 145.87'	N80°W	Joint	0°	N80°W	85°N	Foliation Joint
			48' - 49'	145.87' - 144.87'	N80°W	Foliation	0°	N80°W	60°S	
			49' - 50'	144.87' - 143.87'	SCRIBE MARKS UNREADABLE					
			50' - 54.5'	143.87' - 139.37'	N80°W	Foliation	0°	N80°W	75°N	
			53.5' - 54'	140.47' - 139.87'	N80°W	Joint	0°	N80°W	75°N	Foliation Joint
			54.5' - 57.5'	139.37' - 136.37'	N80°W	Foliation	0°	N80°W	75°N	Foliation Dip Changes at 57.5'
			57.5' - 61'	136.37' - 132.87'	N80°W	Foliation	0°	N80°W	90°	Foliation Vertical
			61' - 67'	132.87' - 126.87'	N80°W	Foliation	10°	N70°W	70°S	Quartzite Banding Starts at 67'
			67' - 68'	126.87' - 125.87'	N80°W	Foliation	0°	N80°W	90°	Foliation Vertical

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
2-17-99	MG-B30-99	VERT	68' - 70'	125.87' - 123.87'	N80°W	Foliation	0°	N80°W	70°S	
			70' - 75'	123.87' - 118.87'	N80°W	Foliation	0°	N80°W	90°	Foliation Vertical
			63.7'	130.17'	N80°W	Joint	10°	N70°W	30°S	With Foliation
			67.75'	126.12'	N80°W	Joint	10°	N70°W	20°N	Across Foliation

Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 25' to 60'

Top of Rock 15'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
2/12/99	MG-B42-99	VERT	27.5'	147.43'	N	Joint	60°W	N60°W	60°S	Across Foliation
			33.5'	141.43'	N	Joint	50°W	N50°W	70°N	Foliation Joint
			28'	146.93'	N	Joint		N30°W	70°S	Across Foliation
			34' - 37'	140.93' - 137.93'	N	Joint	60°W	N60°W	60° - 70°S	Foliation Changes Dip at 33.8' Foliation Joints
			38' - 42'	136.93' - 132.93'	SCRIBE MARKS UNREADABLE					
			42' - 47'	132.93' - 127.93'	N	Foliation	60°W	N60°W	60°N To 90°	Foliation - Drastic Change in Dip
			47.2'	127.73'	N	Joint	60°W	N60°W	30°S	With Foliation Trend
			51.5' - 56'	123.43' - 118.93	N	Foliation	60°W	N60°W	70°N To 90°	Foliation - Drastic Change in Dip
			56' - 60'	118.93' - 114.93'	SCRIBE MARKS UNREADABLE					

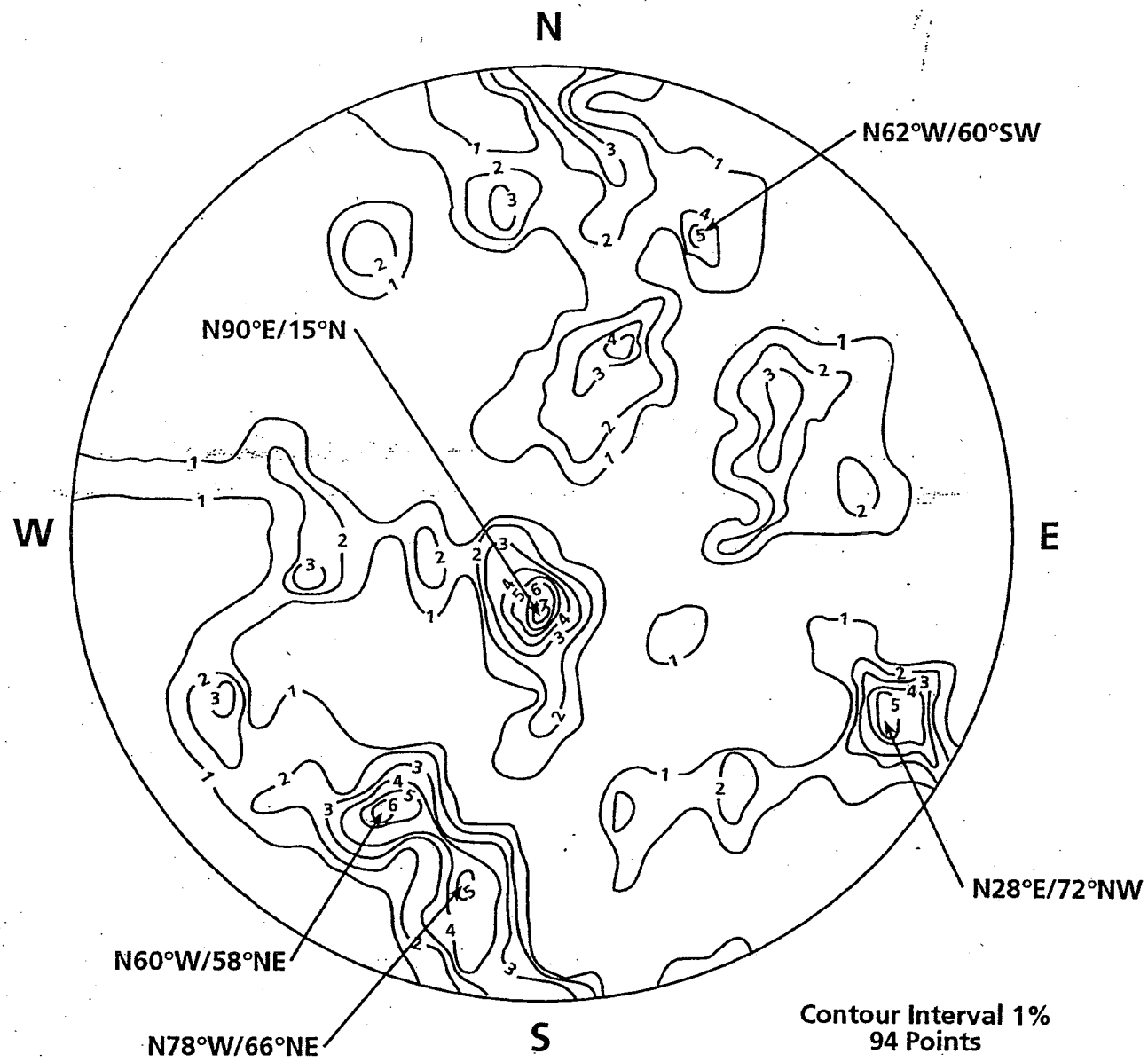
Metcalf & Eddy of New York, Inc.
HAZEN AND SAWYER, P.C.
A Joint Venture

ROCK CORE ORIENTATION MEASUREMENTS

Oriented Core 20' to 55'

Top of Rock 14.5'

DATE	BORING NO.	VERTICAL/ INCLINED	DEPTH/ LENGTH	ELEVAT.	ORIGINAL SCRIBE ORIENTATION	ROCK STRUCTURE	ANGLE OF STRIKE OF ROCK STRUCTURE FROM SCRIBE	STRIKE ORIENTATION	DIP	REMARKS
2/9/99	MGB-45-99	VERT	23' - 27'	153.79' - 149.79'	N	Joint	80°W	N80°W	10°N	Across Foliation
			25' - 26.5'	151.79' - 150.29'	N	Foliation	80°W	N80°W	70°S	
			26.5' - 33.5'	150.29' - 143.29'	N	Foliation	80°W	N80°W	70°S To 90°	Variable Foliation
			33.5' - 55'	143.29' - 121.79'	N	Foliation	80°W	N80°W	60° To 80°N	Variable Foliation
			37'	139.79'	N	Foliation Joint	80°W	N80°W	60°N	
			49.5'	127.29	N	Joint	80°W	N80°W	55°S	Across Foliation



Lower Hemisphere
Plot of Poles to Planes
Croton Oriented Core

03/6406jc

THIS PAGE INTENTIONALLY LEFT BLANK

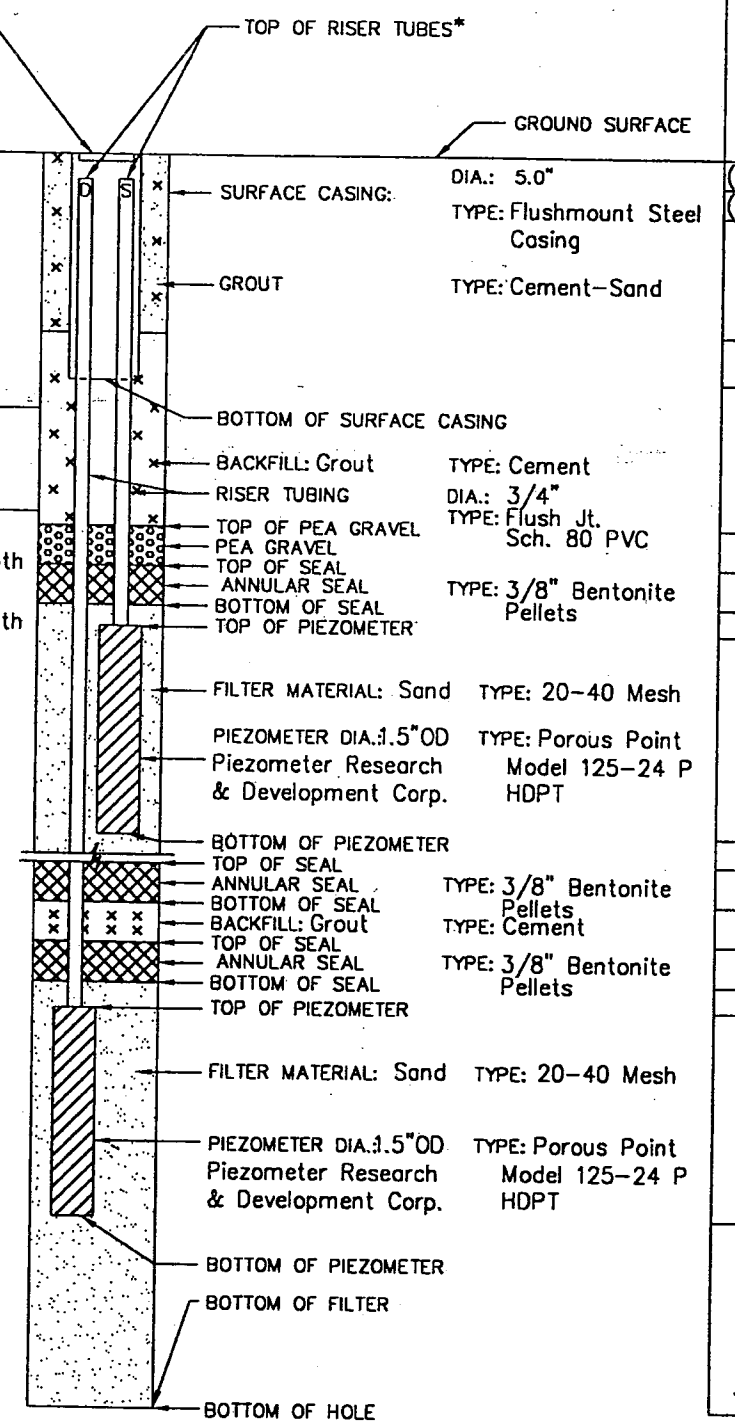
APPENDIX E

PIEZOMETER AND MONITORING WELL LOGS

THIS PAGE INTENTIONALLY LEFT BLANK

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B2S/D-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,039.00	E: 624,359.03	
BEGUN: 3-11-99 SUPERVISOR: E. Acs FINISHED: 3-11-99 DRILLER: G. Marney	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) (S) 8.34 (D) 8.06	ELEV. 185.97 186.35
			DATE 3-24-99 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



Rust brown sandy silt, (ML) (11-65)

4'

Rust brown silty sand, rock fragments (SM) (6-65)

11'

Gneiss (Fordham Formation)
(2-65/3-65) to 24' of depth
(2-65) to 32.7' of depth
(2-65/3-65) to 54' of depth
(1-65) to 133' of depth
(2-65) to 140' of depth
(1-65) to 150' of depth

DEPTH IN FEET	ELEV. IN FEET
0.00	194.63
(D) 0.22	194.41
(S) 0.32	194.31
0.65	193.98
0.70	193.93
74.00	120.63
75.00	119.63
80.00	114.63
82.00	112.63
84.00	110.63
86.00	108.63
89.00	105.63
138.00	56.63
145.00	49.63
147.00	47.63
149.00	45.63
150.00	44.63

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER 3" NQ

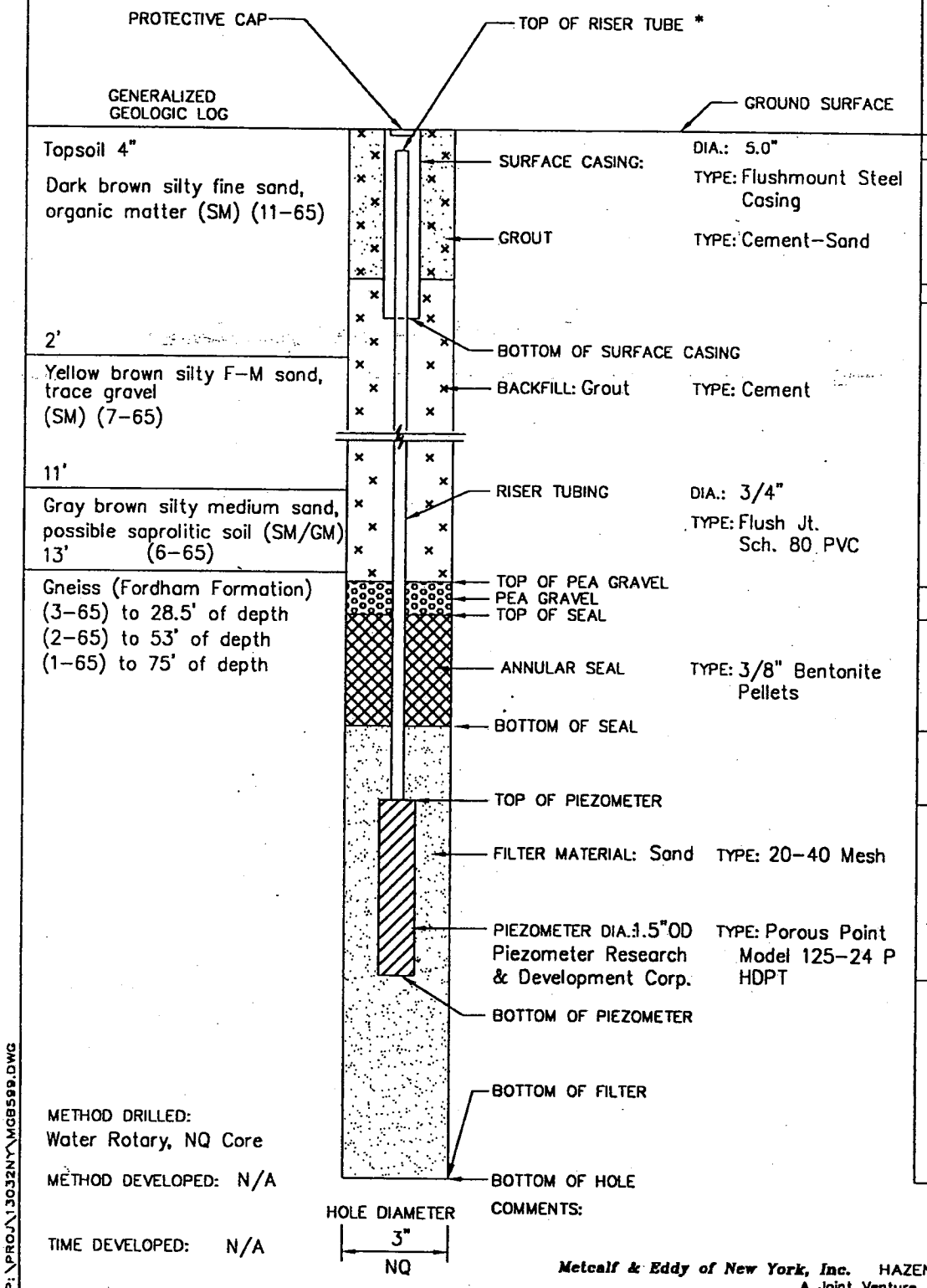
COMMENTS: (S) = Shallow
(D) = Deep

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

P:\PROJ\13032NY\MGB299.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B5-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,336.35	E: 624,394.20	
BEGUN: 3-9-99 / SUPERVISOR: E. Acs / FINISHED: 3-9-99 / DRILLER: R. Bridgpal	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) 13.82	ELEV. 185.58 / DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	199.49
0.09	199.40
0.68	198.81
0.70	198.79
65.00	134.49
66.00	133.49
70.00	129.49
72.00	127.49
74.00	125.49
75.00	124.49

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER 3" NQ

COMMENTS:

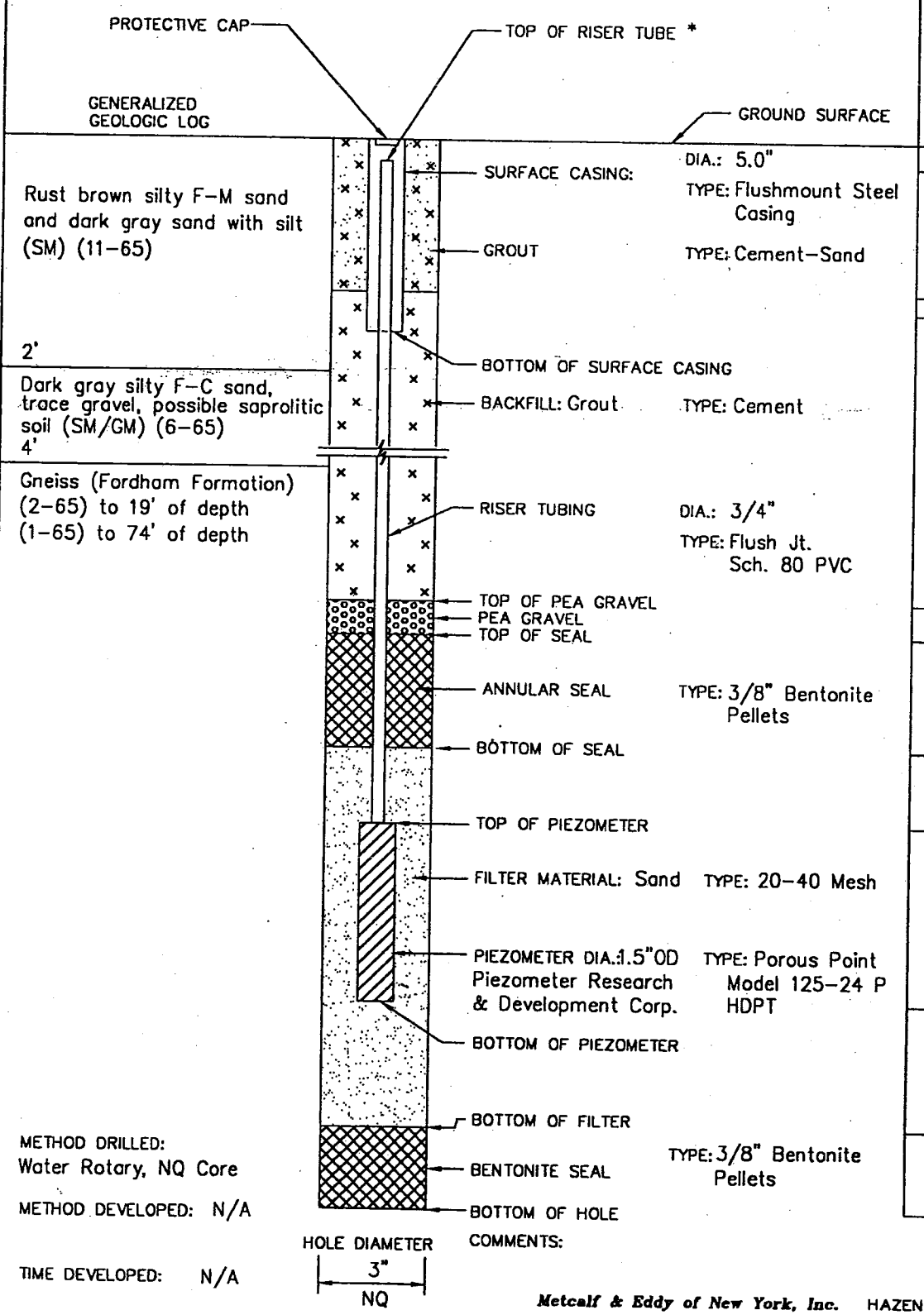
P:\PROJ\13032NY\MGB599.DWG

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

PIEZOMETER INSTALLATION

PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B17-99	
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,420.47	E: 624,708.49	
BEGUN: 3-3-99 / FINISHED: 3-3-99	SUPERVISOR: E. Acs / DRILLER: R. Bridgpal	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) 6.70 / ELEV. 185.54 / DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	192.33
0.09	192.24
0.66	191.67
0.70	196.63
57.00	135.33
58.00	134.33
64.50	127.83
66.50	125.83
68.50	123.83
70.50	121.83
74.00	118.33

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

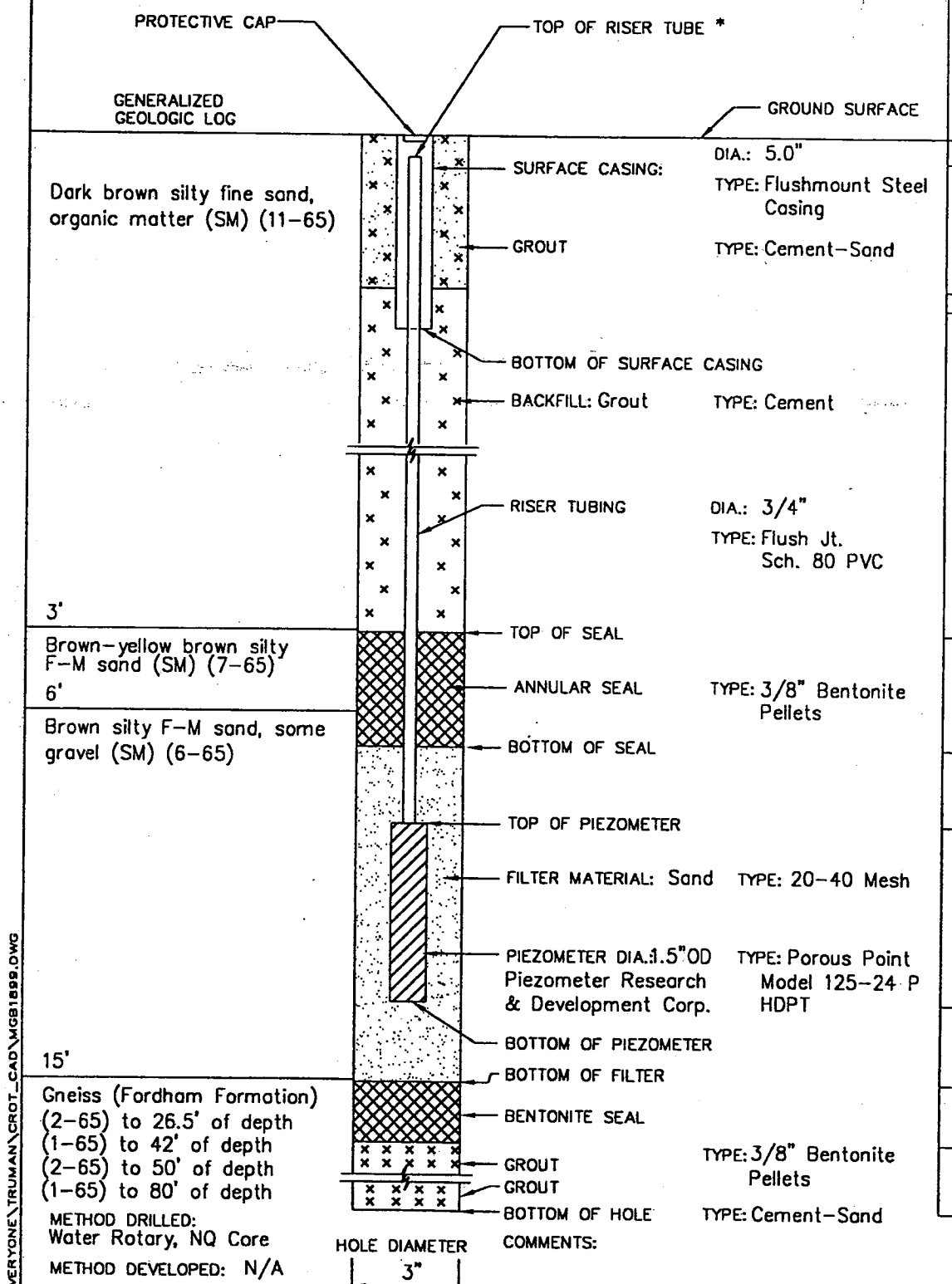
COMMENTS:

P:\EVERYONE\TRUMAN\CROT_CAD\MGB1799.DWG

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C. A Joint Venture

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B18-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 322,893.84	E: 624,742.15	
BEGUN: 3-8-99 / FINISHED: 3-8-99 / SUPERVISOR: E. Acs / DRILLER: J. Harris	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) 8.80	ELEV. 185.86 / DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



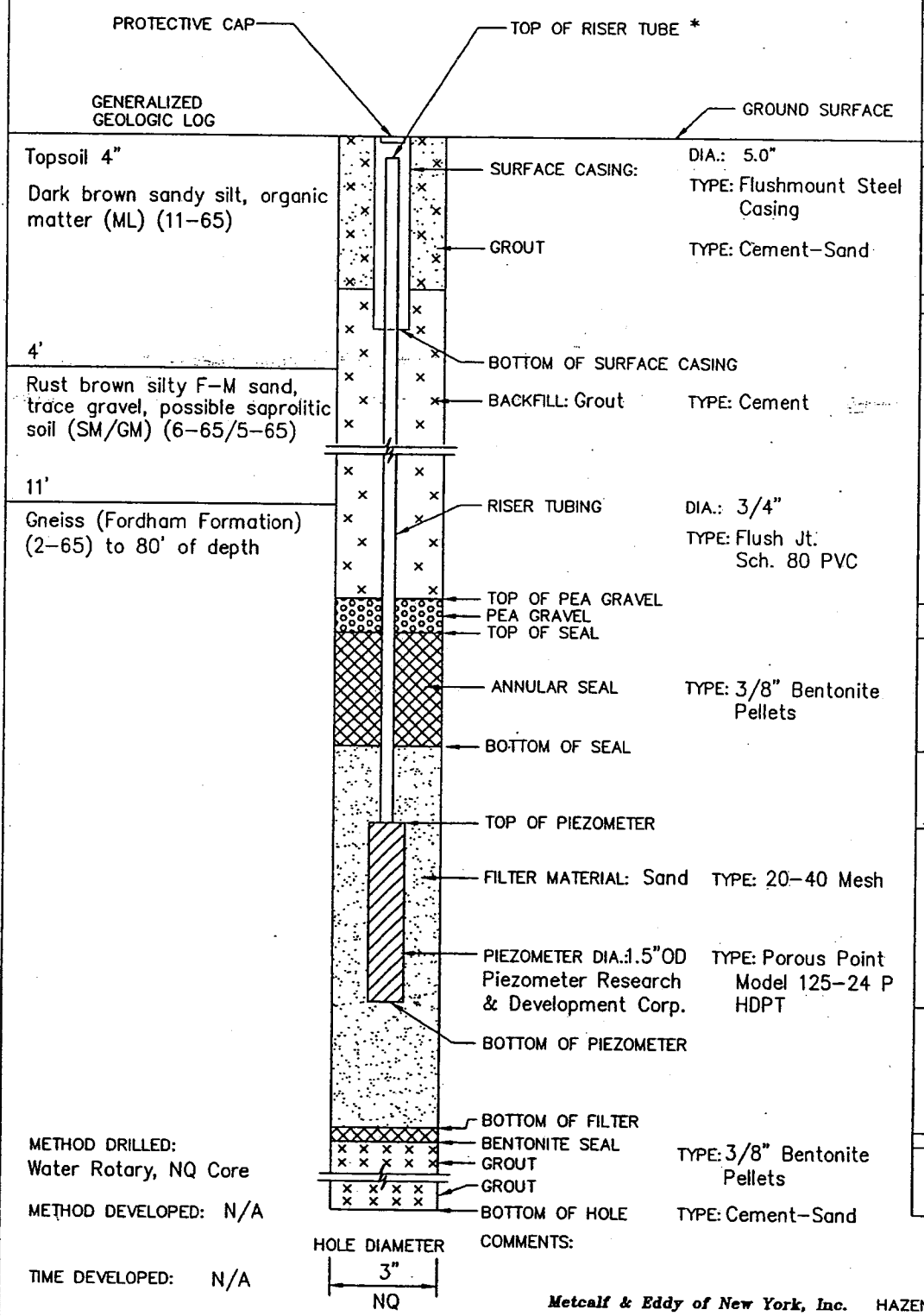
DEPTH IN FEET	ELEV. IN FEET
0.00	194.72
0.06	194.66
0.69	195.41
0.70	195.42
3.00	197.72
7.00	187.72
10.00	184.72
12.00	182.72
14.00	180.72
20.00	174.72
80.00	114.72

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C. A Joint Venture

P:\EVERYONE\TRUMAN\CROT_CAD\MGB1899.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B23-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,124.25	E: 624,872.68	
BEGUN: 3-5-99 SUPERVISOR: E. Acs FINISHED: 3-5-99 DRILLER: J. Harris	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) 11.42	ELEV. 180.88 DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	192.34
0.09	192.30
0.68	191.66
0.70	191.64
63.00	129.34
64.50	127.84
68.50	123.84
66.50	125.84
68.50	123.84
70.50	121.84
75.00	117.34
80.00	112.34

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

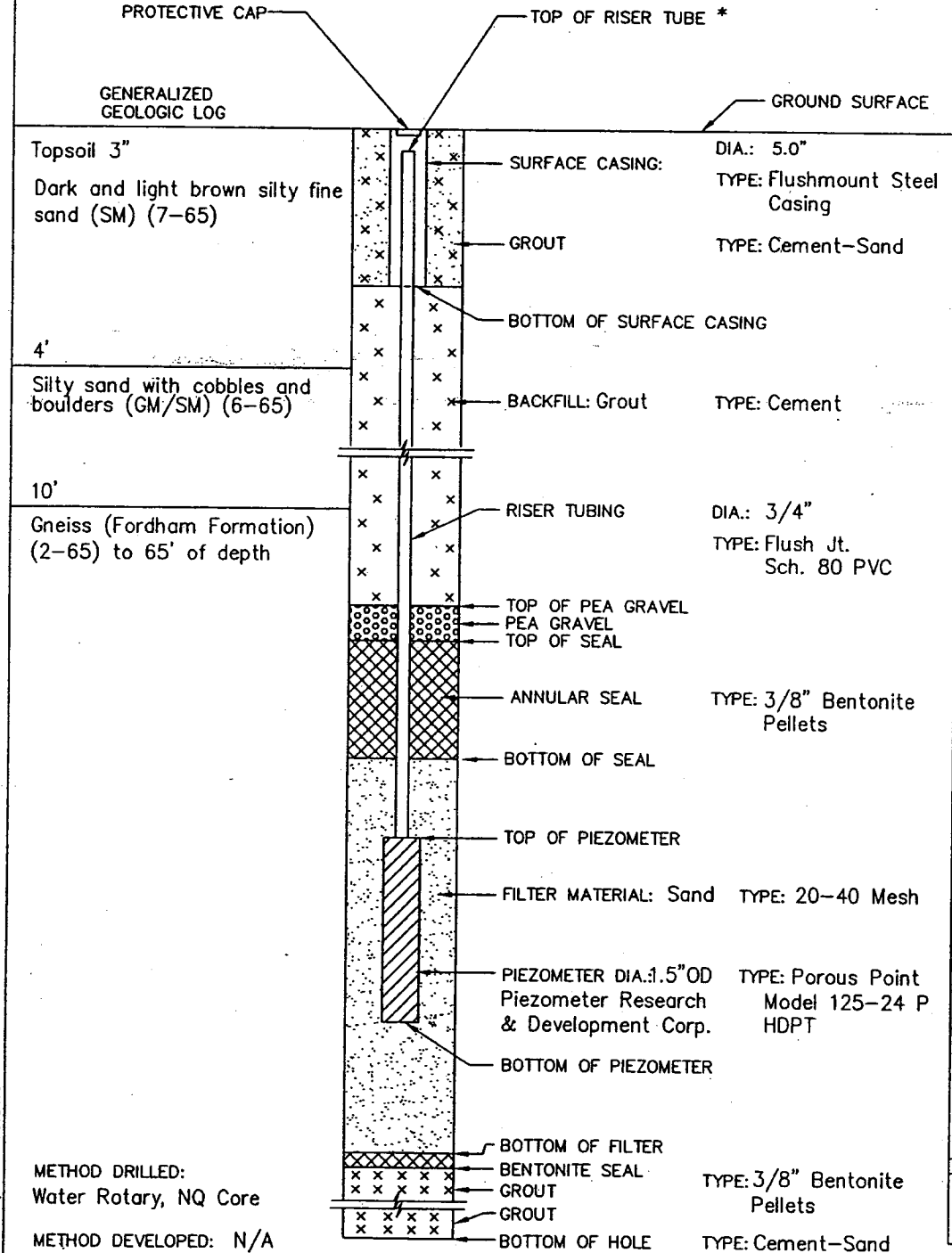
COMMENTS:

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

P:\PROJ\13032NY\MGB2399.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B29-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,392.71	E: 625,005.14	
BEGUN: 3-12-99 / SUPERVISOR: E. Acs / FINISHED: 3-12-99 / DRILLER: J. Harris	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) 3.82	ELEV. 177.85 / DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	181.72
0.05	181.67
0.70	181.02
45.00	136.72
46.00	135.72
50.00	131.72
53.00	128.72
55.00	126.72
57.00	124.72
60.00	121.72
65.00	116.72

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

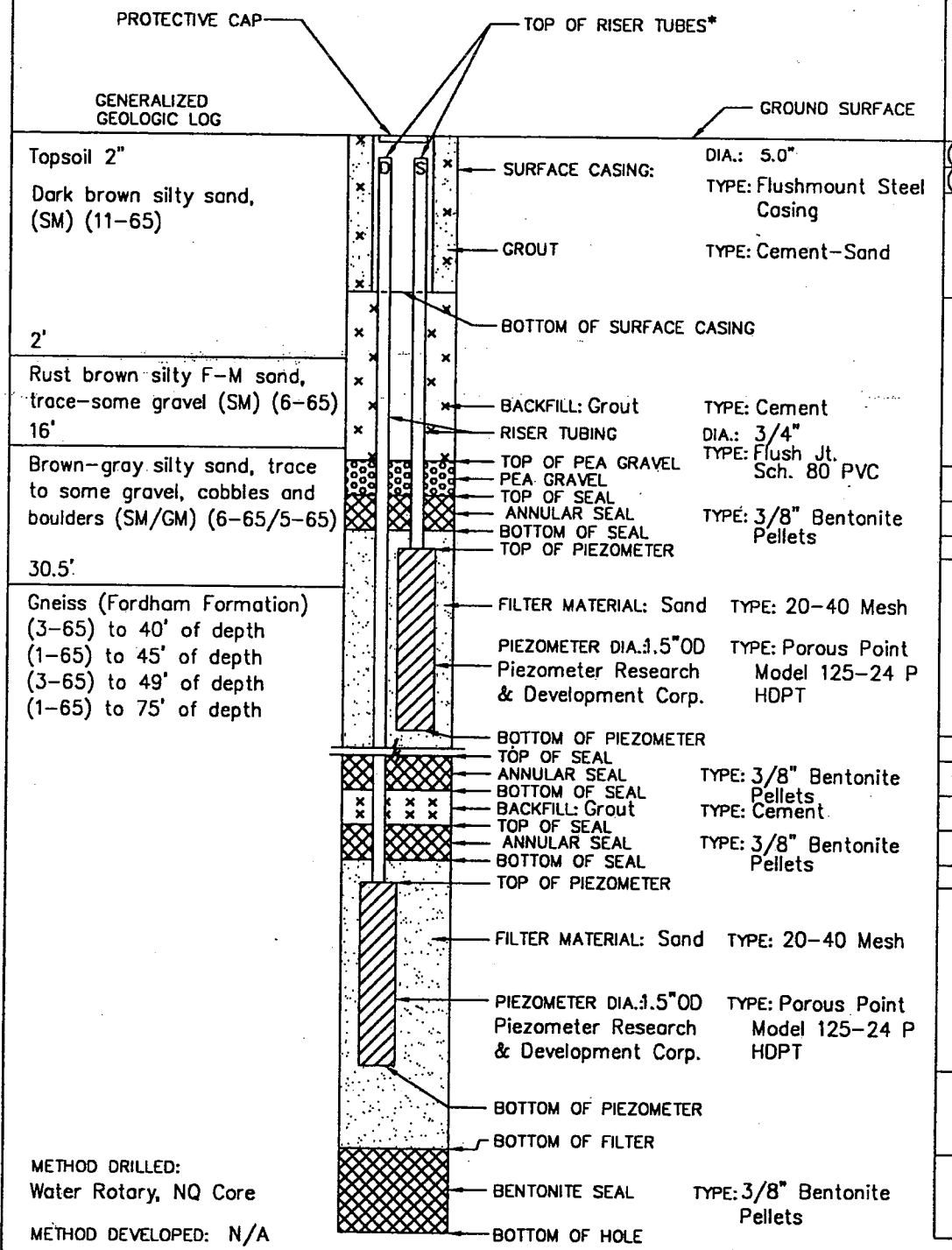
COMMENTS:

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

P:\PROJ\13032NY\MGB2999.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B30S/D-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 322,855.72 E: 625,040.73		
BEGUN: 2-25-99 SUPERVISOR: E. Acs FINISHED: 2-25-99 DRILLER: J. Harris	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) (S) 17.46 (D) 19.14	ELEV. 176.32 174.53	DATE 3-24-99 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



GENERALIZED GEOLOGIC LOG

Topsoil 2"
Dark brown silty sand, (SM) (11-65)
2'

Rust brown silty F-M sand, trace-some gravel (SM) (6-65)
16'

Brown-gray silty sand, trace to some gravel, cobbles and boulders (SM/GM) (6-65/5-65)
30.5'

Gneiss (Fordham Formation)
(3-65) to 40' of depth
(1-65) to 45' of depth
(3-65) to 49' of depth
(1-65) to 75' of depth

DEPTH IN FEET	ELEV. IN FEET
0.00	193.87
(S)0.09	193.78
(D)0.20	193.67
0.70	193.17
20.00	173.87
22.00	171.87
26.00	167.87
30.00	163.87
32.00	161.87
34.00	159.87
39.00	154.87
62.00	131.87
66.00	127.87
68.00	125.87
70.00	123.87
72.00	121.87
75.00	118.87

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER
3"
NQ

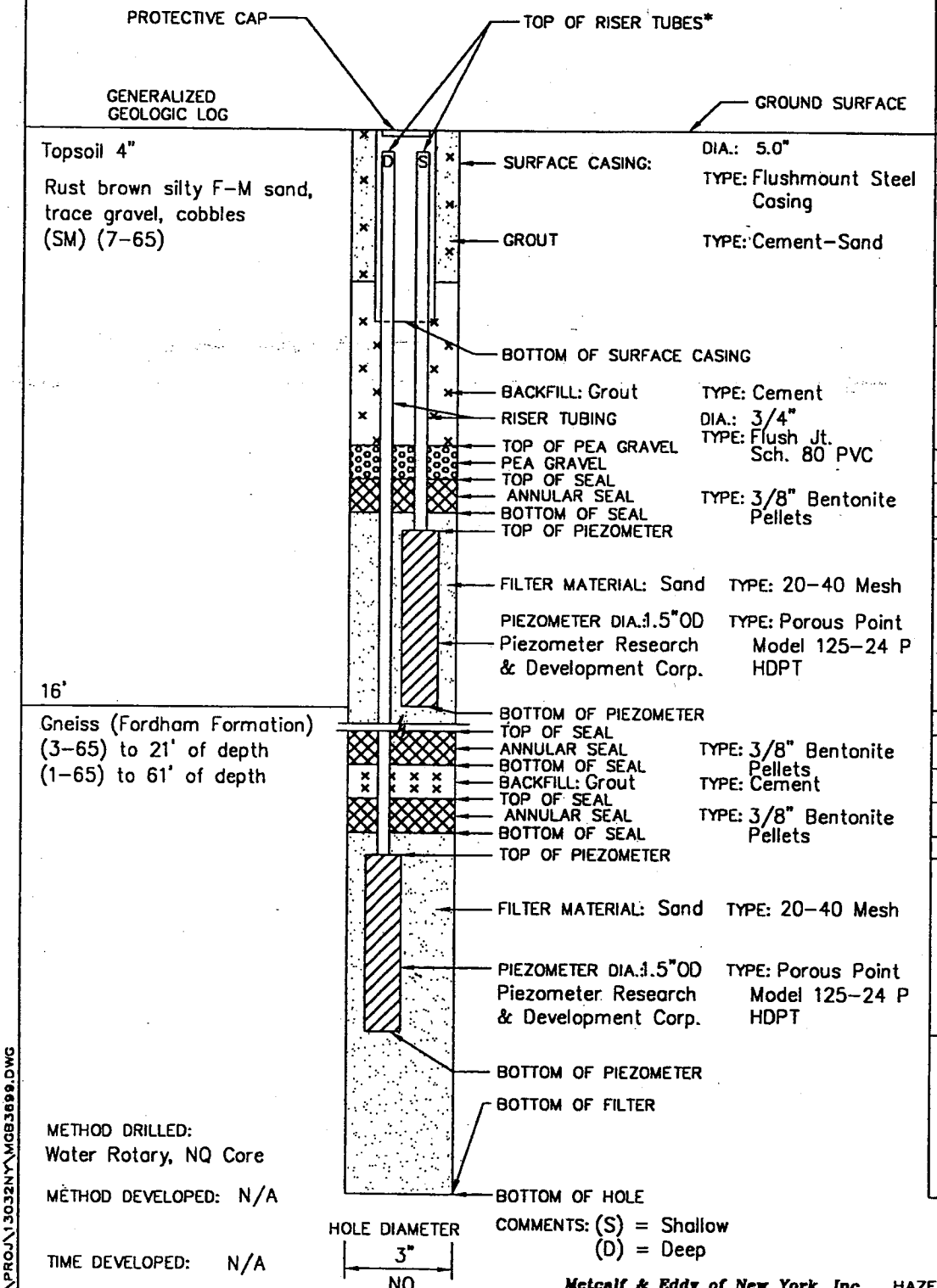
COMMENTS: (S) = Shallow
(D) = Deep

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

P:\PROJ\1303ZNY\MGB3098.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B36S/D-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,190.06	E: 625,183.92	
BEGUN: 3-2-99 / FINISHED: 3-2-99 / SUPERVISOR: E. Acs / DRILLER: G. Suri	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) (S) 7.2 (D) 13.32	ELEV. 175.13 / 169.06 — DATE 3-24-99 / 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	182.43
(D) 0.05	182.38
(S) 0.10	182.33
0.65	181.78
0.70	181.73
7.00	175.43
8.00	174.43
12.00	170.43
14.00	168.43
16.00	166.43
18.00	164.43
20.00	144.43
50.00	132.43
54.00	128.43
56.50	125.93
58.50	123.93
61.00	121.43

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

COMMENTS: (S) = Shallow (D) = Deep

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C. A Joint Venture

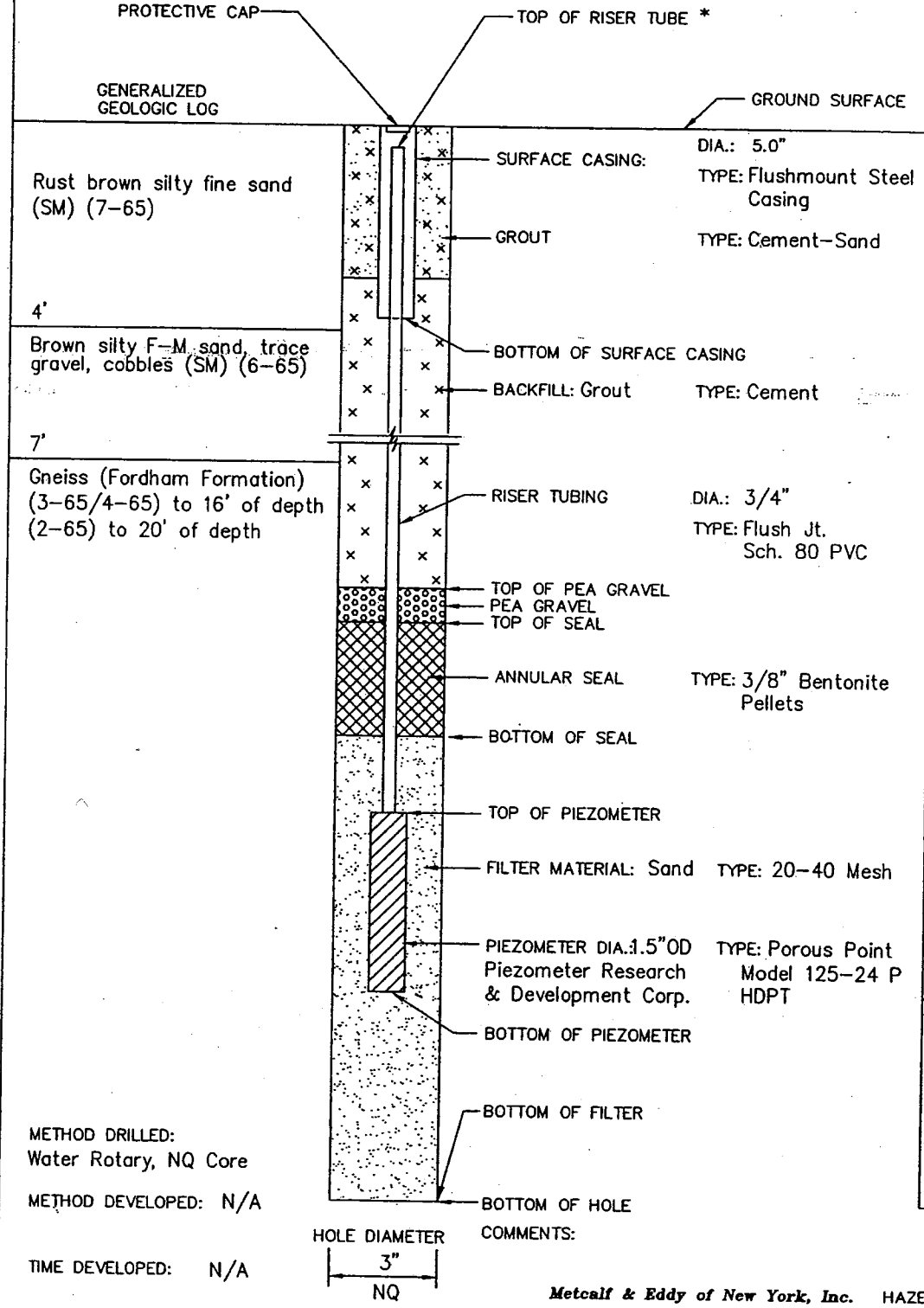
P:\PROJ\13032NY\MGB3699.DWG

PIEZOMETER INSTALLATION

PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B38-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,518.56	E: 625,223.15
BEGUN: 2-23-99 / FINISHED: 2-23-99	SUPERVISOR: E. Acs / DRILLER: G. Marney Jr.	SITE: Van Cortlandt Park, Mosholu Golf Course

WATER DEPTH (FT.)	ELEV.	DATE
6.77	170.11	3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	176.99
0.11	176.88
0.68	176.31
0.70	176.29
8.50	168.49
9.50	167.49
13.50	163.49
16.00	160.49
18.00	158.99
20.00	156.99

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

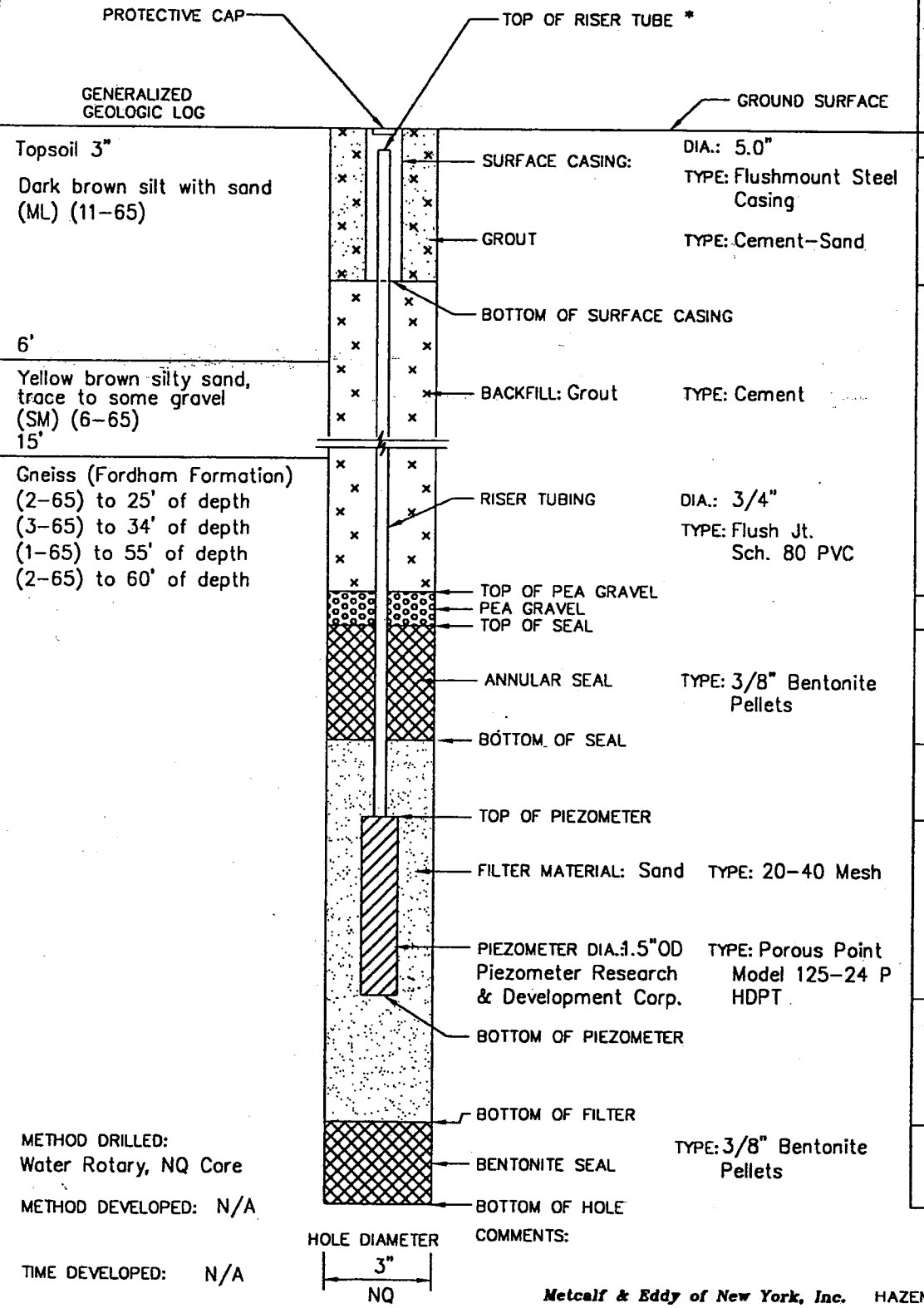
COMMENTS:

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C. A Joint Venture

P:\PROJ\13032NY\MGB3899.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B42-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 322,831.98	E: 625,338.22	
BEGUN: 2-16-99 / FINISHED: 2-16-99 / SUPERVISOR: E. Acs / DRILLER: C. Moriera	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.): 4.33	ELEV.: 170.48 / DATE: 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FEET	ELEV. IN FEET
0.00	174.93
0.12	174.81
0.70	174.23
45.00	129.93
46.00	128.93
48.00	126.93
50.00	124.93
52.00	122.93
54.00	120.93
60.00	114.93

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

COMMENTS:

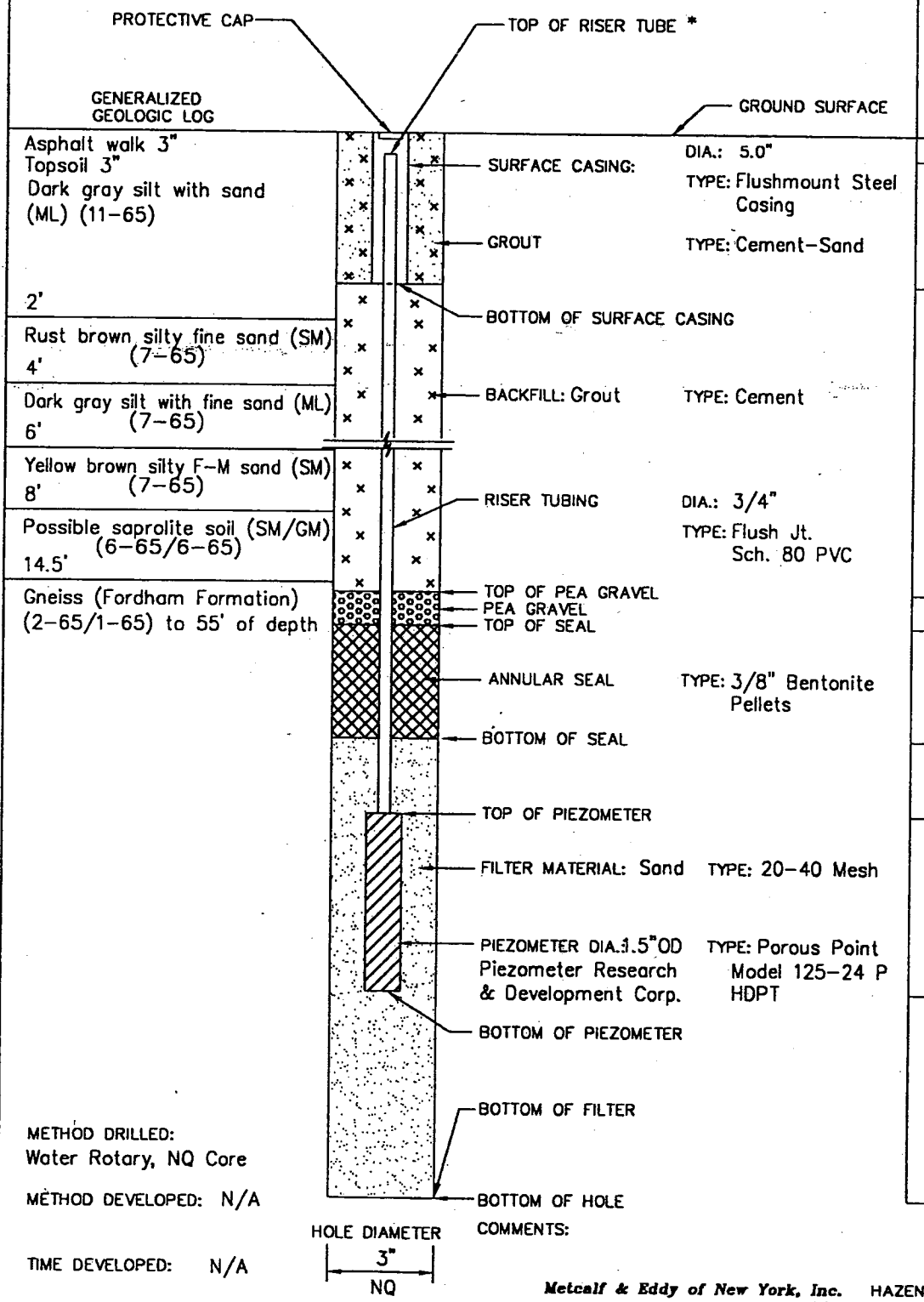
P:\EVERYONE\TRUMAN\CROT_CAD\MGB4299.DWG

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C. A Joint Venture

PIEZOMETER INSTALLATION

PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B45-99	
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,116.71	E: 625,375.14	
BEGUN: 2-10-99 / SUPERVISOR: E. Acs	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) 8.45	ELEV. 168.24
FINISHED: 2-10-99 / DRILLER: C. Moriera			DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



GENERALIZED GEOLOGIC LOG

	DEPTH IN FEET	ELEV. IN FEET
Asphalt walk 3" Topsoil 3" Dark gray silt with sand (ML) (11-65)	0.00	176.79
2'	0.10	176.69
Rust brown silty fine sand (SM) (7-65) 4'	0.70	176.09
Dark gray silt with fine sand (ML) (7-65) 6'		
Yellow brown silty F-M sand (SM) (7-65) 8'		
Possible saprolite soil (SM/GM) (6-65/6-65) 14.5'		
Gneiss (Fordham Formation) (2-65/1-65) to 55' of depth	43.00	133.79
	44.00	132.79
	48.00	128.79
	51.00	125.79
	53.00	123.79
	55.00	121.79

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

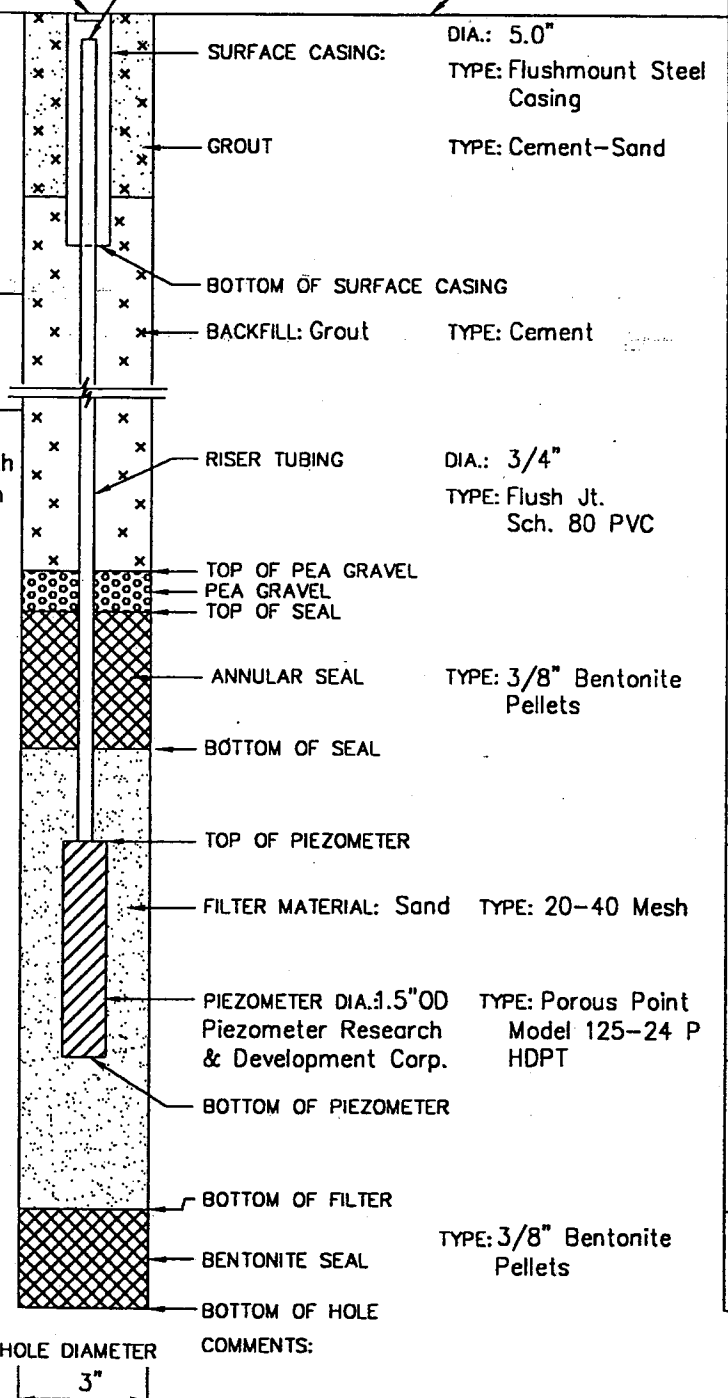
COMMENTS:

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

P:\PROJ\13032NY\MGB45B9.DWG

PIEZOMETER INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B50-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 322,846.45	E: 624,486.32	
BEGUN: 2-16-99 / FINISHED: 2-16-99 / SUPERVISOR: E. Acs / DRILLER: G. Marney	SITE: Van Cortlandt Park, Mosholu Golf Course	WATER DEPTH (FT.) 7.14	ELEV. 186.25 / DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



GENERALIZED GEOLOGIC LOG

Topsoil 3"

Dark brown silty sand (SM) (11-65)

2'

Rust brown silty fine sand, trace to some gravel (SM) (6-65)

7'

Gneiss (Fordham Formation) (4-65/3-65) to 9.5' of depth (1-65/2-65) to 80' of depth

DEPTH IN FEET	ELEV. IN FEET
0.00	193.62
0.23	193.39
0.68	192.94
0.70	192.92
60.00	133.62
61.00	132.62
66.00	127.62
68.00	125.62
70.00	123.62
72.50	121.12
80.00	113.62

METHOD DRILLED: Water Rotary, NQ Core

METHOD DEVELOPED: N/A

TIME DEVELOPED: N/A

HOLE DIAMETER: 3" NQ

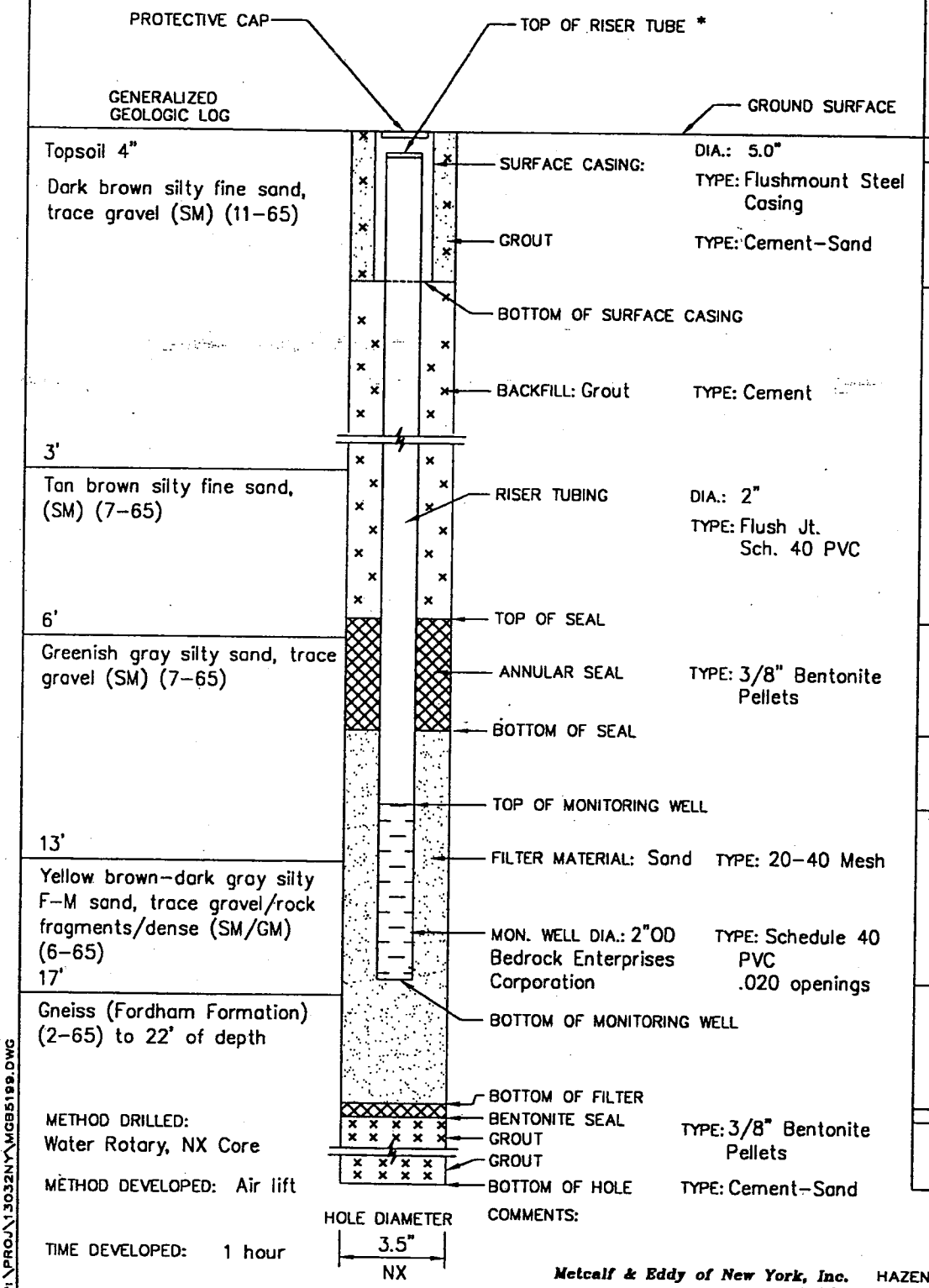
COMMENTS:

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C. A Joint Venture

P:\EVERYONE\TRUMAN\CROT_CAD\MGB5099.DWG

MONITORING WELL INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	PIEZOMETER NO. MG-B51-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,583.36	E: 625,500.11	
BEGUN: 3-17-99 SUPERVISOR: E. Acs FINISHED: 3-18-99 DRILLER: R. Bridgpal	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) 2.42	ELEV. 164.21 DATE 3-24-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



GENERALIZED GEOLOGIC LOG	DEPTH IN FEET	ELEV. IN FEET
	0.00	166.78
Topsoil 4" Dark brown silty fine sand, trace gravel (SM) (11-65)	0.15	166.63
	0.70	166.08
3'		
Tan brown silty fine sand, (SM) (7-65)		
6'	5.00	161.78
Greenish gray silty sand, trace gravel (SM) (7-65)		
	7.00	159.78
	8.00	158.78
13'		
Yellow brown-dark gray silty F-M sand, trace gravel/rock fragments/dense (SM/GM) (6-65)		
17'	16.00	150.78
Gneiss (Fordham Formation) (2-65) to 22' of depth		
	17.00	149.78
	18.00	148.78
	22.00	144.78

METHOD DRILLED: Water Rotary, NX Core

METHOD DEVELOPED: Air lift

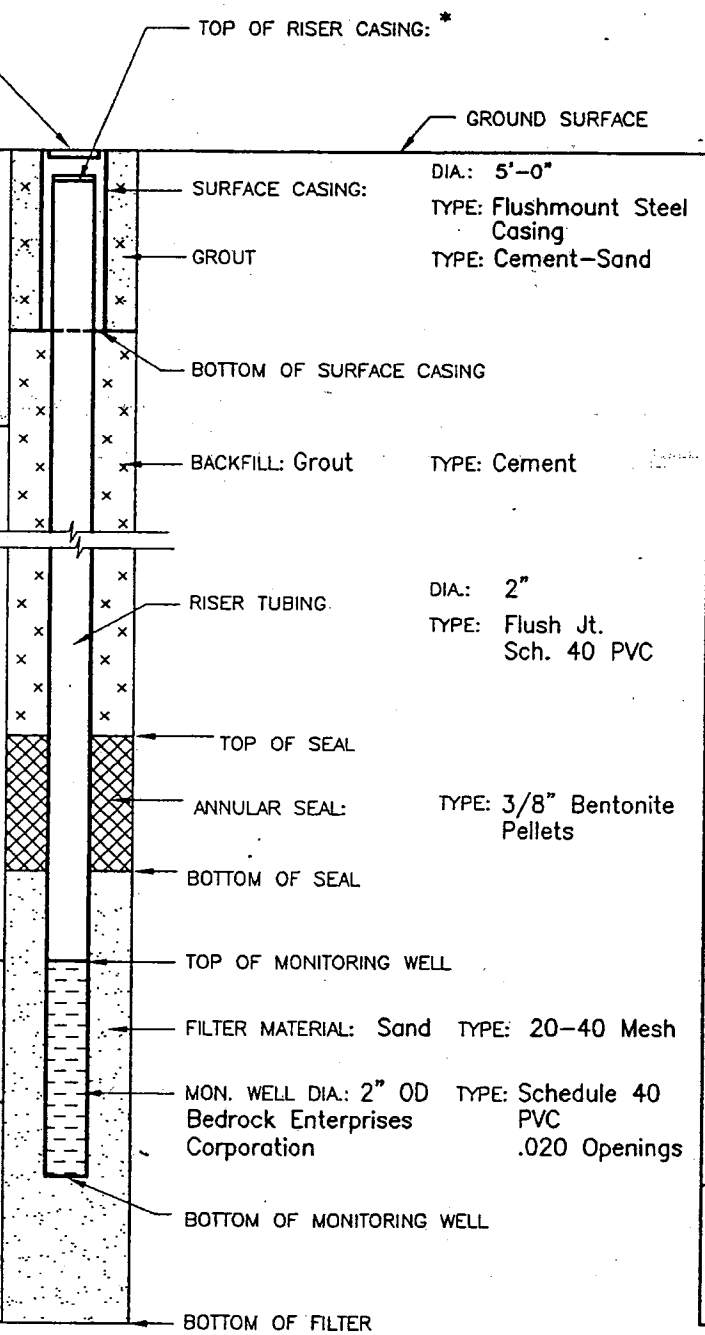
TIME DEVELOPED: 1 hour

P:\PROJ\13032NY\MGB5199.DWG

Metcalf & Eddy of New York, Inc. HAZEN AND SAWYER, P.C.
A Joint Venture

MONITORING WELL INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	WELL NO. MG-B52-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 324,006.96 E: 625,455.73		
BEGUN: 7-24-99 SUPERVISOR: E. Acs FINISHED: 7-24-99 DRILLER: S. Laurenza	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) 2.88	ELEV. 160.57
			DATE 7-28-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



GENERALIZED GEOLOGIC LOG	DEPTH IN FT.	ELEV. IN FT.
	0.00	163.71
Topsoil/Humus 10"	0.26	163.45
Gray Silt with Fine Sand (ML) (11-65)		
	0.70	163.01
3'		
Gray to Tan Brown Silty Fine Sand (SM) (7-65)		
	3.00	160.71
	5.00	158.71
6'		
Gray Fine Sand with some Silt, trace Gravel (SM) (7-65)		
10'		
Yellow Brown Silty Fine to Medium Sand, trace Gravel, Mica, Rock Fragments	16.00	147.71
16', (SM/GM) (6-65)	16.00	147.71

METHOD DRILLED: Tripod Rig

METHOD DEVELOPED: Bailed

TIME DEVELOPED: 1 Hour

HOLE DIAMETER 4" HX

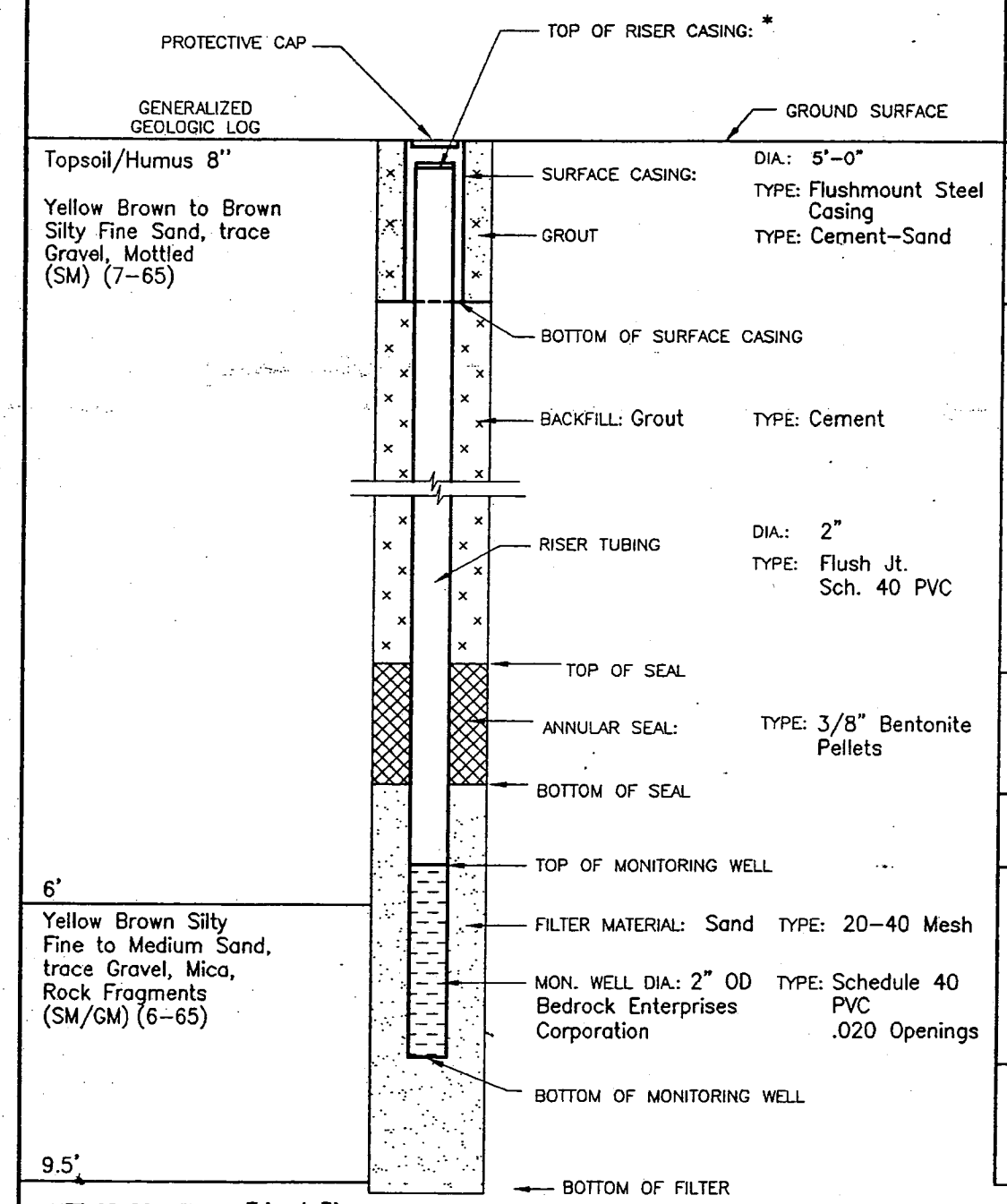
COMMENTS:

P:\DESIGN\CROTON\

Metcalf & Eddy of New York, Inc. **HAZEN AND SAWYER, P.C.**
A Joint Venture

MONITORING WELL INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	WELL NO. MG-B53-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 324,340.42 E: 625,139.18		
BEGUN: 7-27-99 SUPERVISOR: E. Acs FINISHED: 7-27-99 DRILLER: S. Laurenza	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) 5.67	ELEV. 168.59 DATE 7-28-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FT.	ELEV. IN FT.
0.00	174.56
0.30	174.26
0.70	173.86
2.50	172.06
4.00	170.56
5.00	169.56
9.50	165.06
9.50	165.06

METHOD DRILLED: Tripod Rig

METHOD DEVELOPED: Bailed

HOLE DIAMETER 4" HX

COMMENTS:

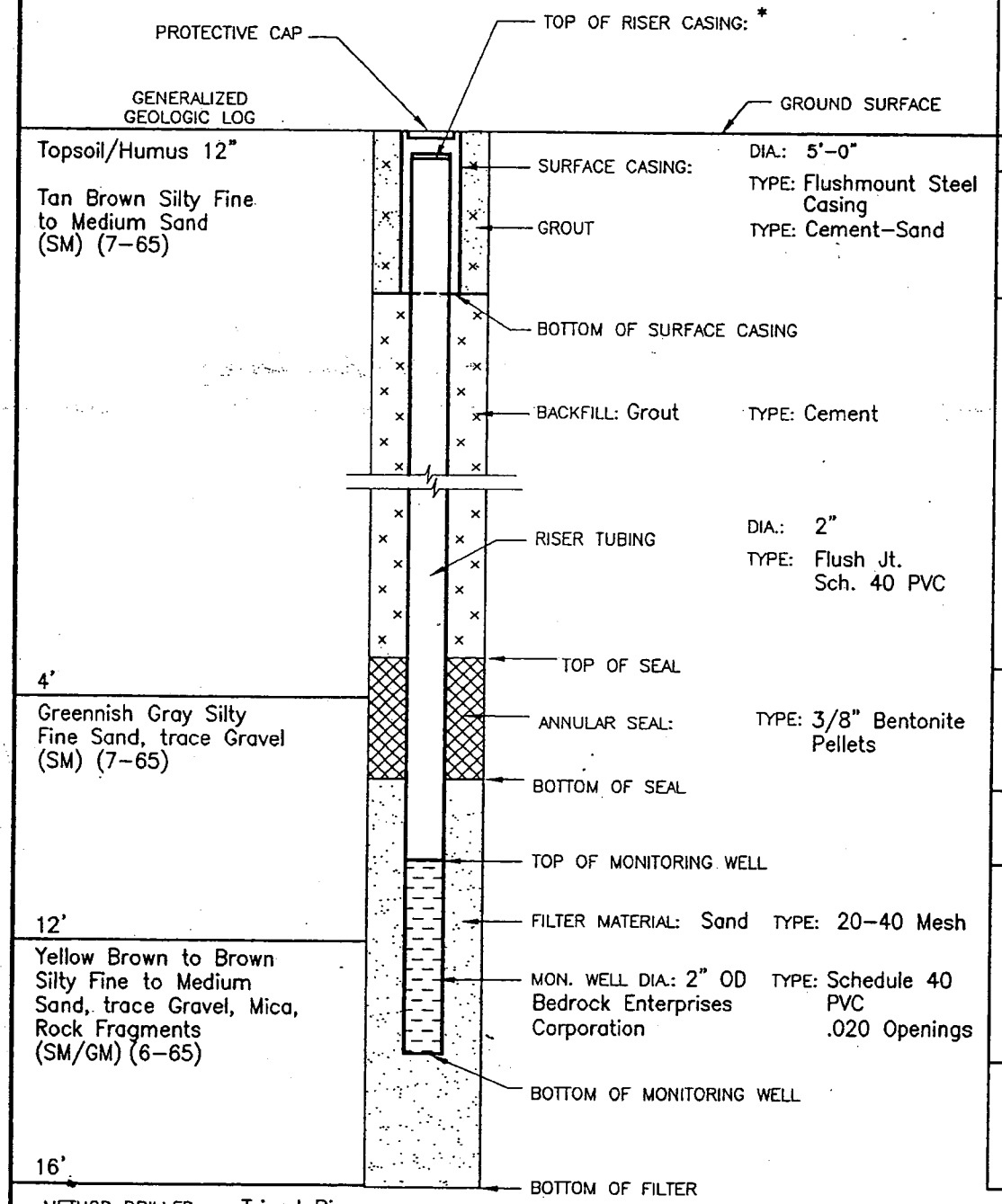
TIME DEVELOPED: 1 Hour

P:\DESIGN\CROTON\

Metcalf & Eddy of New York, Inc. **HAZEN AND SAWYER, P.C.**
A Joint Venture

MONITORING WELL INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	WELL NO. MG-B54-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,722.17 E: 625,513.99		
BEGUN: 7-22-99 SUPERVISOR: E. Acs	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.)	ELEV. / DATE
FINISHED: 7-22-99 DRILLER: S. Laurenza		4.88	158.70 / 7-28-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FT.	ELEV. IN FT.
0.00	163.65
0.07	163.58
0.70	162.95
3.00	160.65
5.00	158.65
5.50	158.15
15.50	148.15
16.00	147.65

METHOD DRILLED: Tripod Rig

METHOD DEVELOPED: Bailed

TIME DEVELOPED: 1 Hour

HOLE DIAMETER: 4" HX

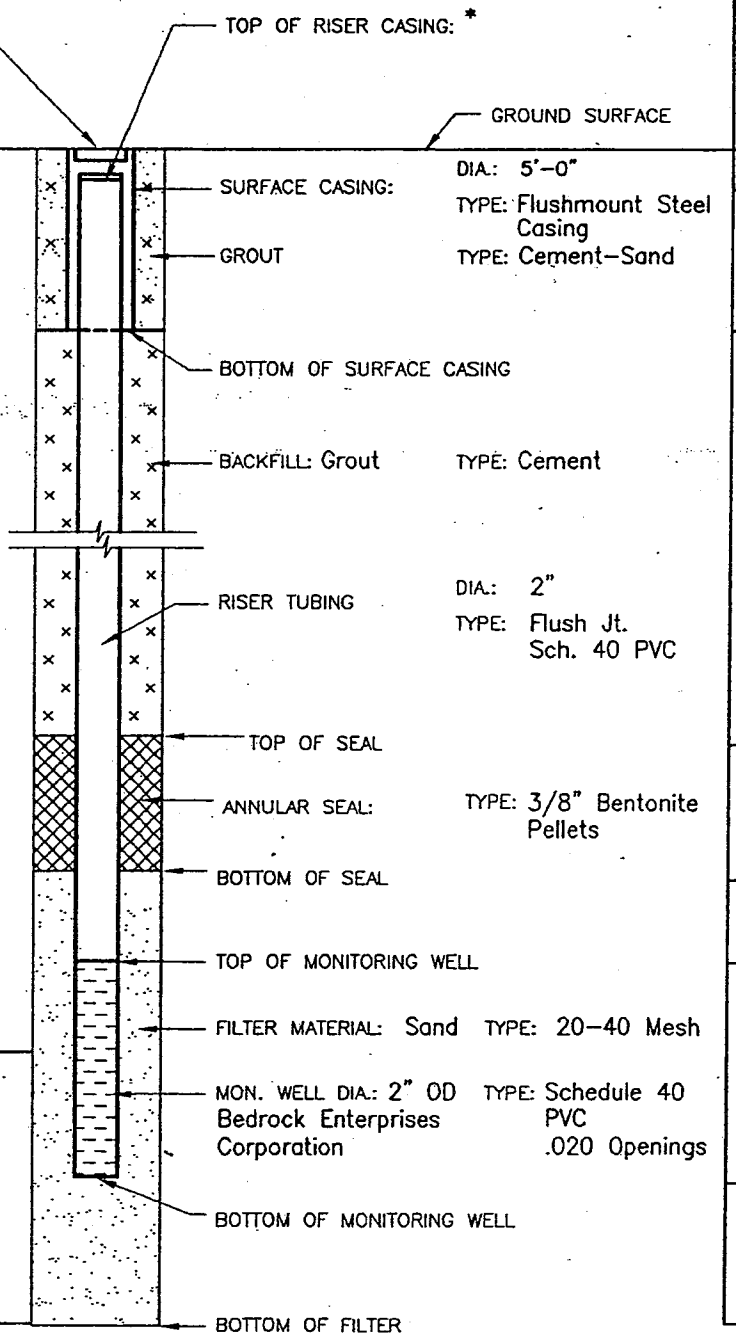
COMMENTS:

P:\DESIGN\CROTON\

Metcalf & Eddy of New York, Inc. **HAZEN AND SAWYER, P.C.**
A Joint Venture

MONITORING WELL INSTALLATION	PROJECT: CROTON WTP	JOB NO. HED-543	WELL NO. MG-B55-99
DRILLING CONTRACTOR: Warren George, Inc.	COORDINATES: N: 323,616.50 E: 624,554.67		
BEGUN: 7-21-99 SUPERVISOR: E. Acs FINISHED: 7-21-99 DRILLER: S. Laurenza	SITE: Van Cortlandt Park Mosholu Golf Course	WATER DEPTH (FT.) 9.03	ELEV. 178.61 DATE 7-28-99

REFERENCE POINT & ELEVATION: * Measuring Point Ref.



DEPTH IN FT.	ELEV. IN FT.
0.00	187.85
0.21	187.64
0.70	185.15
2.00	185.85
3.50	184.35
4.00	183.85
10.00	177.85
10.75	177.10

METHOD DRILLED: Tripod Rig

METHOD DEVELOPED: Bailed

HOLE DIAMETER: 4" HX

COMMENTS:

TIME DEVELOPED: 1 Hour

Metcalf & Eddy of New York, Inc. **HAZEN AND SAWYER, P.C.**
A Joint Venture

P:\DESIGN\CROTON\

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX F

PIEZOMETER AND MONITORING WELL READINGS

THIS PAGE INTENTIONALLY LEFT BLANK

CROTON WTP – CONTRACT HED-543

Piezometer and Monitoring Well Readings

Piezometer	Measuring Point Elevation (ft. MSL)	Measuring Point (Riser Tubing)	Piezometer Elevation	
			Top of Porous Point (ft. MSL)	Bottom of Porous Point (ft. MSL)
MG-B2S-99	194.31	PVC	47.63	45.63
MG-B2D-99	194.41	PVC	112.63	110.63
MG-B5-99	199.40	PVC	127.49	125.49
MG-B17-99	192.24	PVC	125.83	123.83
MG-B18-99	194.66	PVC	184.72	182.72
MG-B23-99	192.30	PVC	125.84	123.84
MG-B29-99	181.67	PVC	128.72	126.72
MG-B30S-99	193.78	PVC	163.87	161.87
MG-B30D-99	193.67	PVC	125.87	123.87
MG-B36S-99	182.33	PVC	168.43	166.43
MG-B36D-99	182.38	PVC	125.93	123.93
MG-B38-99	176.88	PVC	160.99	158.99
MG-B42-99	174.81	PVC	124.93	122.93
MG-B45-99	176.69	PVC	125.79	123.79
MG-B50-99	193.39	PVC	125.62	123.62
MG-B51-99*	166.63	PVC	158.78	150.78
MG-B52-99*	163.45	PVC	157.71	147.71
MG-B53-99*	174.26	PVC	169.56	165.06
MG-B54-99*	163.58	PVC	158.15	148.15
MG-B55-99*	187.64	PVC	183.85	177.85

* Monitoring Well

CROTON WTP – CONTRACT HED-543

Piezometer and Monitoring Well Readings

Piezometer	3/12/99 Water Elev. (ft. MSL)	3/18/99 Water Elev. (ft. MSL)	3/23/99 Water Elev. (ft. MSL)	3/24/99 Water Elev. (ft. MSL)	3/25/99 Water Elev. (ft. MSL)
MG-B2S-99	184.51	184.99	185.93	185.97	185.83
MG-B2D-99	186.30	185.93	186.29	186.35	186.40
MG-B5-99	184.27	184.71	185.63	185.58	185.53
MG-B17-99	184.61	184.65	185.48	185.54	185.39
MG-B18-99	184.44	184.64	185.84	185.86	185.90
MG-B23-99	179.30	179.78	180.74	180.88	180.84
MG-B29-99	176.27	177.37	177.89	177.85	177.91
MG-B30S-99	175.10	175.62	176.36	176.32	176.60
MG-B30D-99	174.40	174.41	174.57	174.53	174.43
MG-B36S-99	173.51	173.62	175.18	175.13	175.29
MG-B36D-99	168.93	168.66	169.16	169.06	168.98
MG-B38-99	169.28	169.70	170.16	170.11	169.98
MG-B42-99	169.11	169.80	170.45	170.48	170.56
MG-B45-99	165.91	166.31	168.17	168.24	168.22
MG-B50-99	186.33	186.40	186.15	186.25	186.28
MG-B51-99*	--	164.23	164.23	164.21	164.32

* Monitoring Well

CROTON WTP – CONTRACT HED-543

Piezometer and Monitoring Well Readings

Piezometer	3/30/99 Water Elev. (ft. MSL)	4/26/99 Water Elev. (ft. MSL)	7/21/99 Water Elev. (ft. MSL)	7/28/99 Water Elev. (ft. MSL)	9/10/99 Water Elev. (ft. MSL)
MG-B2S-99	185.73	183.93	178.65	178.17	176.95
MG-B2D-99	186.29	184.49	179.33	178.77	177.68
MG-B5-99	185.63	184.34	178.57	178.00	176.56
MG-B17-99	185.14	183.06	177.84	177.44	176.65
MG-B18-99	186.28	184.06	DRY	DRY	DRY
MG-B23-99	181.50	181.02	177.14	176.66	174.86
MG-B29-99	178.39	177.37	173.61	173.20	171.63
MG-B30S-99	177.36	178.34	175.56	175.19	175.21
MG-B30D-99	174.44	174.47	177.85	176.88	173.11
MG-B36S-99	174.79	173.11	170.03	169.67	168.35
MG-B36D-99	169.10	167.98	166.21	165.79	163.88
MG-B38-99	169.70	169.10	164.84	164.22	164.26
MG-B42-99	170.05	168.77	165.88	165.51	164.97
MG-B45-99	166.68	165.42	162.81	162.50	162.68
MG-B50-99	186.33	184.25	179.31	178.83	178.07
MG-B51-99*	164.11	163.74	159.17	158.54	159.92
MG-B52-99*				160.57	161.98
MG-B53-99*				168.59	166.42
MG-B54-99*				158.70	160.74
MG-B55-99*				178.61	DRY

* Monitoring Well

CROTON WTP – CONTRACT HED-543

Piezometer and Monitoring Well Readings

Piezometer	10/5/99 Water Elev. (ft. MSL)	11/5/99 Water Elev. (ft. MSL)	12/7/99 Water Elev. (ft. MSL)	1/5/00 Water Elev. (ft. MSL)	2/4/00 Water Elev. (ft. MSL)
MG-B2S-99	181.21	180.15	180.05	182.63	182.17
MG-B2D-99	182.03	181.17	181.21	182.51	183.19
MG-B5-99	180.58	179.70	179.96	182.44	182.82
MG-B17-99	180.55	179.91	180.32	182.38	181.74
MG-B18-99	DRY	DRY	DRY	183.49	183.22
MG-B23-99	177.46	177.20	177.16	179.02	179.46
MG-B29-99	174.81	174.61	174.85	176.45	176.73
MG-B30S-99	174.62	174.36	174.06	175.36	176.38
MG-B30D-99	177.56	177.19	174.85	175.03	175.43
MG-B36S-99	171.41	170.46	170.34	172.29	172.09
MG-B36D-99	166.41	166.40	166.43	167.68	167.72
MG-B38-99	167.50	157.78	157.78	169.14	168.59
MG-B42-99	166.82	166.79	167.19	168.06	168.27
MG-B45-99	164.69	164.37	164.45	165.23	164.95
MG-B50-99	182.27	181.47	181.63	183.72	183.06
MG-B51-99*	162.67	163.15	163.83	164.01	163.67
MG-B52-99*	163.59	163.71	163.74	163.97	163.73
MG-B53-99*	171.82	172.22	173.76	174.82	174.58
MG-B54-99*	162.92	163.14	163.53	163.54	163.56
MG-B55-99*	181.49	180.86	181.95	183.98	183.76

* Monitoring Well

CROTON WTP – CONTRACT HED-543

Piezometer and Monitoring Well Readings

Piezometer	3/17/00 Water Elev. (ft. MSL)	3/31/00 Water Elev. (ft. MSL)	5/8/00 Water Elev. (ft. MSL)	6/9/00 Water Elev. (ft. MSL)	7/7/00 Water Elev. (ft. MSL)
MG-B2S-99	182.79	183.31	183.67	182.67	181.08
MG-B2D-99	183.99	184.36	184.55	183.83	182.03
MG-B5-99	184.80	184.48	184.28	183.66	181.48
MG-B17-99	183.06	183.08	182.90	182.90	180.26
MG-B18-99	183.88	184.41	184.84	183.62	182.90
MG-B23-99	180.44	180.78	181.26	181.06	179.62
MG-B29-99	178.33	178.21	178.02	179.19	176.45
MG-B30S-99	177.50	177.96	179.17	178.96	178.08
MG-B30D-99	176.87	177.15	178.12	177.91	177.67
MG-B36S-99	173.61	173.71	173.98	174.95	172.49
MG-B36D-99	168.52	168.70	168.84	168.60	167.83
MG-B38-99	169.84	169.58	169.25	169.78	167.60
MG-B42-99	170.25	170.01	169.65	170.61	167.52
MG-B45-99	166.09	165.97	165.59	166.67	164.15
MG-B50-99	184.27	184.31	184.13	184.01	181.63
MG-B51-99*	164.51	164.12	163.73	164.21	161.94
MG-B52-99*	163.73	163.73	163.73	163.73	163.64
MG-B53-99*	174.60	174.61	174.08	174.68	172.89
MG-B54-99*	163.69	163.56	163.57	163.57	162.32
MG-B55-99*	188.20	186.49	185.04	186.32	181.70

* Monitoring Well

CROTON WTP – CONTRACT HED-543

Piezometer and Monitoring Well Readings

Piezometer	8/4/00 Water Elev. (ft. MSL)	9/1/00 Water Elev. (ft. MSL)	10/7/00 Water Elev. (ft. MSL)	11/4/00 Water Elev. (ft. MSL)	Water Elev. (ft. MSL)
MG-B2S-99	181.33	181.25	180.27	178.99	
MG-B2D-99	182.61	182.21	181.17	179.65	
MG-B5-99	181.46	181.40	180.12	178.92	
MG-B17-99	181.80	180.56	179.76	178.46	
MG-B18-99	DRY	182.76	DRY	DRY	
MG-B23-99	179.77	179.34	178.38	177.26	
MG-B29-99	177.87	176.47	175.69	174.35	
MG-B30S-99	177.74	177.46	176.34	175.24	
MG-B30D-99	177.53	176.95	175.81	174.85	
MG-B36S-99	174.11	172.65	171.99	170.53	
MG-B36D-99	167.20	167.40	167.10	166.14	
MG-B38-99	169.14	168.14	167.94	167.24	
MG-B42-99	169.07	167.25	166.67	165.89	
MG-B45-99	166.13	164.35	163.87	163.15	
MG-B50-99	183.14	181.99	181.25	179.87	
MG-B51-99*	163.93	162.41	162.49	162.09	
MG-B52-99*	163.73	163.73	163.73	163.59	
MG-B53-99*	173.62	172.44	171.42	170.00	
MG-B54-99*	163.42	162.66	162.80	162.68	
MG-B55-99*	183.78	181.96	181.02	179.68	

* Monitoring Well

APPENDIX G

FALLING HEAD TEST DATA

THIS PAGE INTENTIONALLY LEFT BLANK

CROTON WTP-CONTRACT HED 543
MOSHOLU GOLF COURSE
FALLING HEAD TEST RESULTS

Depth of Test From Ground Surface (ft.)	Top of Casing to Static Water Table (H_o) (ft.)	Casing Height Above Ground Surface (ft.)	Casing Diameter (ID) (ft.)	Length of Sampler Penetration (ft.)	Sampler Diameter (OD) (ft.)	Water Level Drop from Top of Casing (H) (ft.) Time (minutes)																Permeability (cm/sec)
						0.5	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	
MG-B2-99																						
9 - 11	8.5	1	0.25	2	0.17	0		0.04	0.08	0.13	0.17	0.18	0.25	0.29	0.33	0.38	0.42	0.46	0.52	0.56	0.6	0.65	5.06E-05
MG-B5-99																						
9 - 11	16.13	1	0.25	2	0.17	0.04	0.08	0.13	0.25	0.42	0.58	0.83	0.92	1.08	1.13	1.17	1.25	1.33	1.42	1.5	1.58		7.23E-05
MG-B30-99																						
20	21.11	2	0.25	NA	NA	1.5		3	4.5	5.5	9.5	11	11.5	12	13	13.5	14	15	15.5	16.5	17	17	2.04E-03
30	24.1	5.0	0.25	NA	NA	1.5		6.7	13.8	16.7	19.9	20.7	21.5	22	22.3	22.4	22.5						4.43E-03
MG-B32-99																						
8	6.5	2	0.33	NA	NA	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01							No Take
12 - 14	7.5	3	0.33	2	0.17	0.01	0.02	0.03	0.04	0.04	0.06	0.07	0.07	0.07	0.07								2.82E-05
MG-B36-99																						
9.33	11.59	2.67	0.33	NA	NA	0	0.01	0.01	0.02	0.04	0.05	0.06	0.08	0.08	0.08	0.08	0.09	0.09	0.1	0.11	0.14		1.28E-05
10.5	10.22	1.3	0.33	NA	NA	0	0	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.1	0.1	0.1	0.1	0.1	0.1	9.94E-06
MG-B51-99																						
1 - 3	3.4	1	0.25	2	0.17	0.96	1	1.04	1.17	1.21	1.27	1.31	1.35	1.38									2.16E-04
4 - 6	3.4	1	0.25	2	0.17	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79									No Take
7 - 9	5.4	3	0.25	2	0.17	0	0	0	0	0	0	0	0	0									No Take
10 - 12	4.4	2	0.25	2	0.17	0.08	0.12	0.13	0.19	0.25	0.31	0.38	0.44	0.48									1.57E-04
13 - 15	4.4	2	0.25	2	0.17	0.01	0.02	0.03	0.07	0.1	0.15	0.19	0.23	0.26									9.33E-05
16 - 16.25	3.4	1	0.25	0.25	0.17	0.04	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08									No Take

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX H

PACKER TEST DATA

THIS PAGE INTENTIONALLY LEFT BLANK

CROTON WTP-CONTRACT HED 543
MOSHOLU GOLF COURSE
PACKER TESTS RESULTS

BORING	GROUND ELEVATION (ft.)	TEST ELEVATION (ft.) FROM	TO	TEST LENGTH (ft.)	WATER TAKE (gpm)	HOLE RADIUS (ft.)	TOTAL HEAD (ft.)	PERMEABILITY "K" (cm/sec)
MG-B2-99	194.63	44.63	54.63	10	3	0.124	331.3	4.29E-05
		54.63	64.63	10	35.5	0.124	243.7	6.91E-04
		64.63	74.63	10	42.4	0.124	243.7	8.25E-04
		74.63	84.63	10	No Take	0.124	110	No Take
		114.63	124.63	10	0.2	0.124	91.5	1.04E-05
		124.63	134.63	10	0.2	0.124	80	1.04E-05
		134.63	144.63	10	0.2	0.124	68.5	No Take
		144.63	154.63	10	0.2	0.124	56.9	1.67E-05
		154.63	164.63	10	30	0.124	77.7	1.83E-03
		164.63	174.63	10	6.0	0.124	54.6	8.40E-04
MG-B5-99	199.49	124.49	134.49	10	0.2	0.124	177.5	1.00E-05
		134.49	144.49	10	2.1	0.124	154.5	6.29E-05
		144.49	154.49	10	3.2	0.124	131.4	1.15E-04
		154.49	164.49	10	1.6	0.124	59.9	1.23E-04
		164.49	174.49	10	0.2	0.124	48.4	1.96E-05
		174.49	184.49	10	2.1	0.124	62.2	1.60E-04
MG-B17-99	192.33	118.33	127.33	9	2	0.124	160.6	6.40E-05
		127.33	137.33	10	1.1	0.124	137.6	3.79E-05
		137.33	147.33	10	14	0.124	114.5	5.80E-04
		147.33	157.33	10	No Take	0.124	91.5	No Take
		157.33	167.33	10	1	0.124	68.4	6.93E-05
		167.33	177.33	10	1.3	0.124	45.3	1.32E-04
		177.33	187.33	10	11	0.124	22.3	2.34E-03
MG-B18-99	194.72	114.72	124.72	10	No Take	0.124	174.4	No Take
		124.72	134.72	10	No Take	0.124	151.4	No Take
		134.72	144.72	10	2	0.124	128.3	7.39E-05
		144.72	154.72	10	2	0.124	105.3	9.01E-05
		154.72	164.72	10	1	0.124	82.2	5.77E-05
		164.72	174.72	10	1	0.124	59.1	8.02E-05
MG-B23-99	192.34	112.34	118.34	6	12	0.124	178.5	4.70E-04
		118.34	128.34	10	No Take	0.124	154.4	No Take
(Could not build up pressure		128.34	138.34	10	30	0.124	14.9	9.56E-03
at Elev. 128.34'-148.34'. Pump		138.34	148.34	10	30	0.124	14.9	9.56E-03
at max. flow of 30 gpm.)		148.34	158.34	10	24	0.124	85.2	1.34E-03
		158.34	168.34	10	20	0.124	62.2	1.53E-03
		168.34	178.34	10	No Take	0.124	39.1	No Take
MG-B29-99	181.72	116.72	126.72	10	No Take	0.124	150.4	No Take
		126.72	136.72	10	1	0.124	127.3	7.04E-05
		136.72	146.72	10	No Take	0.124	104.3	No Take
		146.72	156.72	10	No Take	0.124	81.2	No Take
		156.72	166.72	10	No Take	0.124	58.1	No Take
MG-B30-99	193.87	118.87	123.87	5	No Take	0.124	166.5	No Take
		123.87	133.87	10	No Take	0.124	145.5	No Take
		133.87	143.87	10	No Take	0.124	122.4	No Take
		143.87	153.87	10	No Take	0.124	99.4	No Take
		153.87	163.87	10	No Take	0.124	NA	No Take
MG-B36-99	182.43	121.43	132.43	11	No Take	0.124	161.8	No Take
		132.43	142.43	10	4	0.124	138.7	1.37E-04
		142.43	152.43	10	No Take	0.124	115.6	No Take
		152.43	162.43	10	1	0.124	92.6	5.12E-05
MG-B42-99	174.93	114.93	124.93	10	No Take	0.124	139.2	No Take
		124.93	134.93	10	No Take	0.124	116.1	No Take
		134.93	144.93	10	No Take	0.124	92.1	No Take
		144.93	154.93	10	8	0.124	69	5.50E-04
		154.93	159.93	5	No Take	0.124	48.5	No Take
MG-B45-99	176.79	121.79	131.79	10	No Take	0.124	120.2	No Take
		131.79	141.79	10	No Take	0.124	97.2	No Take
		141.79	151.79	10	No Take	0.124	74.1	No Take
		151.79	161.79	10	No Take	0.124	51	No Take
MG-B50-99	193.62	113.62	123.62	10	3	0.124	183.7	7.74E-05
		123.62	133.62	10	22	0.124	160.7	6.49E-04
		133.62	143.62	10	20	0.124	137.6	6.89E-04
		143.62	153.62	10	1.2	0.124	114.5	4.97E-05
		153.62	163.62	10	No Take	0.124	91.5	No Take
		163.62	173.62	10	0.45	0.124	68.4	3.12E-05

MG-B2-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B2-99	150	140	10	8.11	5	0.8	69	0.124	0	0.5	172.2	Single
3/10/99						0.8				1		Packer
						0.9				2		
						0.1				3		
						0				5		
				8.11	5	1.3	138		0	0.5	331.3	Double
						1.5				1		Packer
						2.6				2		
						2.8				3		
						4.7				5		
				8.11	5	0.7	69		0	0.5	172.2	
						0.7				1		
						1.6				2		
						1.7				3		
						2.9				5		
	140	130	10	8.11	5	14.8	64		0	0.5	160.7	
						13.7				1		
						28				2		
						27.8				3		
						55.4				5		
				8.11	5	16.1	100		0	0.5	243.7	
						17.2				1		
						35.2				2		
						34.8				3		
						71				5		
				8.11	5	15	64		0	0.5	160.7	
						14.4				1		
						28.5				2		
						27.9				3		
						54.6				5		
	130	120	10	8.11	5	16.2	59		0	0.5	149.2	
						14				1		
						29.2				2		
						29.4				3		
						56.8				5		
				8.11	5	21.2	100		0	0.5	243.7	
						20.6				1		
						36.8				2		
						37.1				3		
						62.5				5		

MG-B2-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
				8.11	5	12.5	59		0	0.5	149.2	
						12.3				1		
						23.5				2		
						23.4				3		
						47.2				5		
	120	110	10	8.11	5	0	21		0	0.5	61.5	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	42		0	0.5	110.0	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	21		0	0.5	61.5	
						0				1		
						0				2		
						0				3		
						0				5		
	80	70	10	8.11	5	0	34		0	0.5	91.5	
						0.1				1		
						0.2				2		
						0.2				3		
						0.3				5		
				8.11	5	0.1	68		0	0.5	169.9	
						0				1		
						0.1				2		
						0.2				3		
						0.2				5		
				8.11	5	0	34		0	0.5	91.5	
						0				1		
						0				2		
						0				3		
						0				5		
	70	60	10	8.11	5	0	29		0	0.5	80.0	
						0.1				1		
						0				2		
						0.1				3		
						0				5		

MG-B2-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
				8.11	5	0	58		0	0.5	146.9	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	29		0	0.5	80.0	
						0				1		
						0				2		
						0				3		
						0				5		
	60	50	10	8.11	5	0	24		0	0.5	68.5	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	48		0	0.5	123.8	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	24		0	0.5	68.5	
						0				1		
						0				2		
						0				3		
						0				5		
	50	40	10	8.11	5	0	19		0	0.5	56.9	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	38		0	0.5	100.7	
						0				1		
						0				2		
						0				3		
						0				5		
				8.11	5	0	19		0	0.5	56.9	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B2-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	40	30	10	8.11	5	8.8	14		0	0.5	45.4	
						8.7				1		
						17.5				2		
						17.8				3		
						35.9				5		
				8.11	5	15	28		0	0.5	77.7	
						15				1		
						30				2		
						30				3		
						59				5		
				8.11	5	12	14		0	0.5	45.4	
						11				1		
						24				2		
						25				3		
						47				5		
	30	20	10	8.11	5	7	9		0	0.5	33.9	
						6				1		
						10				2		
						7.5				3		
						13.9				5		
				8.11	5	3.9	18		0	0.5	54.6	
						3.9				1		
						7.7				2		
						7.6				3		
						14.7				5		
				8.11	5	2.8	9		0	0.5	33.9	
						2.8				1		
						5.7				2		
						5.7				3		
						11.3				5		

MG-B5-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B5-99	75	65	10	10	1.5	0	36	0.124	0	0.5	94.5	Single
3/9/99						0				1		Packer
						0.1				2		
						0.2				3		
						0.4				5		
				10	1.5	0	72		0	0.5	177.5	Double
						0				1		Packer
						0.1				2		
						0.1				3		
						0.2				5		
				10	1.5	0	36		0	0.5	94.5	
						0				1		
						0				2		
						0.1				3		
						0.2				5		
	65	55	10	10	1.5	0.1	31		0	0.5	83.0	
						0.2				1		
						0.3				2		
						0.7				3		
						2				5		
				10	1.5	0	62		0	0.5	154.5	
						0.2				1		
						1				2		
						2				3		
						4.1				5		
				10	1.5	0	31		0	0.5	83.0	
						0				1		
						0.1				2		
						0.2				3		
						1				5		
	55	45	10	10	1.5	0.2	26		0	0.5	71.5	
						0.4				1		
						0.9				2		
						2.2				3		
						4.8				5		
				10	1.5	0.4	52		0	0.5	131.4	
						0.6				1		
						1.2				2		
						3.2				3		
						5.2				5		
				10	1.5	0	26		0	0.5	71.5	
						0.2				1		
						0.1				2		
						0.1				3		
						0.2				5		

MG-B5-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	45	35	10	10	1.5	0.2	21		0	0.5	59.9	
						0.3				1		
						0.6				2		
						1.2				3		
						3.1				5		
				10	1.5	0.1	42		0	0.5	108.4	
						0.3				1		
						0.4				2		
						0.7				3		
						1.4				5		
				10	1.5	0	21		0	0.5	59.9	
						0				1		
						0.2				2		
						0.4				3		
						0.7				5		
	35	25	10	10	1.5	0	16		0	0.5	48.4	
						0				1		
						0.1				2		
						0.2				3		
						0.4				5		
				10	1.5	0	32		0	0.5	85.3	
						0				1		
						0				2		
						0.1				3		
						0.2				5		
				10	1.5	0	16		0	0.5	48.4	
						0				1		
						0				2		
						0				3		
						0.1				5		
	25	15	10	10	1.5	0.2	11		0	0.5	36.9	
						0.2				1		
						0.4				2		
						0.6				3		
						2				5		
				10	1.5	0	22		0	0.5	62.2	
						0.4				1		
						1.1				2		
						2.1				3		
						4.2				5		
				10	1.5	0	11		0	0.5	36.9	
						0.2				1		
						0.2				2		
						0.4				3		
						1.2				5		

MG-B17-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B17-99	74	65	9	8.14	2.6	1	65	0.124	0	0.5	160.6	Single
3/2/99						2				1		Packer
						3.5				2		
						2.5				3		
						4				5		
				8.14	2.6	0.5	65		0	0.5	160.6	
						0.8				1		
						1				2		
						1.5				3		
						2				5		
	65	55	10	8.14	2.6	0.5	55		0	0.5	137.6	Double
						1.1				1		Packer
						2				2		
						3				3		
						5.2				5		
				8.14	2.6	0.2	55		0	0.5	137.6	
						0.5				1		
						1				2		
						2				3		
						4				5		
	55	45	10	8.14	2.6	4	45		0	0.5	114.5	
						6.5				1		
						22				2		
						33				3		
						48				5		
				8.14	2.6	8	45		0	0.5	114.5	
						14				1		
						24				2		
						30				3		
						45				5		
	45	35	10	8.14	2.6	0	18		0	0.5	52.2	
						0				1		
						0				2		
						0				3		
						0				5		
				8.14	2.6	0	35		0	0.5	91.5	
						0				1		
						0				2		
						0				3		
						0				5		
				8.14	2.6	0	18		0	0.5	52.2	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B17-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	35	25	10	8.14	2.6	0.8	25		0	0.5	68.4	
						0.5				1		
						1				2		
						2				3		
						2.2				5		
				8.14	2.6	0.5	25		0	0.5	68.4	
						0.7				1		
						1.1				2		
						2.1				3		
						2.8				5		
	25	15	10	8.14	2.6	0.1	15		0	0.5	45.3	
						1.1				1		
						2.1				2		
						3.8				3		
						5				5		
				8.14	2.6	0.2	15		0	0.5	45.3	
						0.5				1		
						1.1				2		
						1.5				3		
						3				5		
	15	5	10	8.14	2.6	5	5		0	0.5	22.3	
						11				1		
						17				2		
						23				3		
						36				5		
				8.14	2.6	5	5		0	0.5	22.3	
						10				1		
						16				2		
						20				3		
						28				5		

MG-B18-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B18-99	80	70	10	11.02	2	0	35	0.124	0	0.5	93.7	Single
3/5/99						0				1		Packer
						0				2		until
						0				3		noted
						0				5		
				11.02	2	0	70		0	0.5	174.4	
						0				1		
						0				2		
						0				3		
						0				5		
				11.02	2	0	35		0	0.5	93.7	
						0				1		
						0				2		
						0				3		
						0				5		
	70	60	10	11.02	2	0	30		0	0.5	82.2	
						0				1		
						0				2		
						0				3		
						0				5		
				11.02	2	0	60		0	0.5	151.4	
						0				1		
						0				2		
						0				3		
						0				5		
				11.02	2	0	30		0	0.5	82.2	
						0				1		
						0				2		
						0				3		
						0				5		
	60	50	10	11.02	2	0	25		0	0.5	70.7	
						0				1		
						0				2		
						0				3		
						0				5		
				11.02	2	1.5	50		0	0.5	128.3	
						1				1		
						1				2		
						1				3		
						2				5		
				11.02	2	0	25		0	0.5	70.7	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B18-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	50	40	10	11.02	2	0	20		0	0.5	59.1	Double
						0				1		Packer
						0				2		
						0				3		
						0				5		
				11.02	2	0.5	40		0	0.5	105.3	
						1				1		
						1				2		
						1				3		
						2				5		
				11.02	2	0	20		0	0.5	59.1	
						0				1		
						0				2		
						0				3		
						0				5		
	40	30	10	11.02	2	0	15		0	0.5	47.6	
						0				1		
						0				2		
						0				3		
						0				5		
				11.02	2	0.2	30		0	0.5	82.2	
						0.5				1		
						0.5				2		
						0.5				3		
						1				5		
				11.02	2	0	15		0	0.5	47.6	
						0				1		
						0				2		
						0				3		
						0				5		
	30	20	10	11.02	2	0	10		0	0.5	36.1	
						0				1		
						0				2		
						0				3		
						0				5		
				11.02	2	0.2	20		0	0.5	59.1	
						0.5				1		
						0.5				2		
						0.5				3		
						1				5		
				11.02	2	0	10		0	0.5	36.1	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B23-99

	TEST DEPTH		TEST	DEPTH T	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B23-99	80	74	6	13.88	2	7	70.5	0.124	0	0.5	178.5	Single
3/4/99						5				1		Packer
						10				2		
						12				3		
						22				5		
				13.88	2	4	70.5		0	0.5	178.5	
						6				1		
						9				2		
						12				3		
						22				5		
	74	64	10	13.88	1	0	31		0	0.5	86.4	Double
						0				1		Packer
						0				2		
						0				3		
						0				5		
				13.88	1	0	60.5		0	0.5	154.4	
						0				1		
						0				2		
						0				3		
						0				5		
				13.88	1	0	31		0	0.5	86.4	
						0				1		
						0				2		
						0				3		
						0				5		
	64	54	10	13.88	1	15	0		0	0.5	14.9	Maximum
						15				1		pump flow
						30				2		30 gpm. Not
						30				3		able to
						60				5		build
												pressure.
	54	44	10	13.88	1	15	0		0	0.5	14.9	
						15				1		
						30				2		
						30				3		
						60				5		
	44	34	10	13.88	1	7	30.5		0	0.5	85.2	
						12				1		
						14				2		
						16				3		
						24				5		
				13.88	1	7	30.5		0	0.5	85.2	
						11				1		
						11				2		
						12				3		
						24				5		

MG-B23-99

	TEST DEPTH		TEST	DEPTH T	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	34	24	10	13.88	1	4.5	20.5		0	0.5	62.2	
						4				1		
						5				2		
						5				3		
						8				5		
				13.88	1	4	20.5		0	0.5	62.2	
						10				1		
						10				2		
						10				3		
						20				5		
	24	14	10	13.88	1	0	6		0	0.5	28.7	
						0				1		
						0				2		
						0				3		
						0				5		
				13.88	1	0	10.5		0	0.5	39.1	
						0				1		
						0				2		
						0				3		
						0				5		
				13.88	1	0	6		0	0.5	28.7	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B29-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B29-99	65	55	10	5.4	2	0	31	0.124	0	0.5	78.9	Single
						0				1		Packer
						0				2		
						0				3		
						0				5		
				5.4	2	0	62		0	0.5	150.4	
						0				1		
						0				2		
						0				3		
						0				5		
				5.4	2	0	31		0	0.5	78.9	
						0				1		
						0				2		
						0				3		
						0				5		
	55	45	10	5.4	2	0.5	26		0	0.5	67.4	
						0.5				1		
						0.5				2		
						0.5				3		
						0.7				5		
				5.4	2	0.2	52		0	0.5	127.3	
						0.5				1		
						0.5				2		
						0.5				3		
						0.8				5		
				5.4	2	0	26		0	0.5	67.4	
						0				1		
						0				2		
						0				3		
						0				5		
	45	35	10	5.4	2	0	21		0	0.5	55.8	Double
						0				1		Packer
						0				2		
						0				3		
						0				5		
				5.4	2	0	42		0	0.5	104.3	
						0				1		
						0				2		
						0				3		
						0				5		
				5.4	2	0	21		0	0.5	55.8	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B29-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	35	25	10	5.4	2	0	16		0	0.5	44.3	
						0				1		
						0				2		
						0				3		
						0				5		
				5.4	2	0	32		0	0.5	81.2	
						0				1		
						0				2		
						0				3		
						0				5		
				5.4	2	0	16		0	0.5	44.3	
						0				1		
						0				2		
						0				3		
						0				5		
	25	15	10	5.4	2	0	11		0	0.5	32.8	
						0				1		
						0				2		
						0				3		
						0				5		
				5.4	2	0	22		0	0.5	58.1	
						0				1		
						0				2		
						0				3		
						0				5		
				5.4	2	0	11		0	0.5	32.8	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B30-99

	TEST DEPTH		TEST	DEPTH T	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B30-99	75	70	5	19.41	3	0	32	0.124	0	0.5	96.2	Single
2/24/99						0				1		Packer
						0				2		for all
						0				3		intervals
						0				5		
				19.41	3	0	62.5		0	0.5	166.5	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	3	0	32		0	0.5	96.2	
						0				1		
						0				2		
						0				3		
						0				5		
	70	60	10	19.41	5	0	27		0	0.5	86.7	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	5	0	52.5		0	0.5	145.5	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	5	0	27		0	0.5	86.7	
						0				1		
						0				2		
						0				3		
						0				5		
	60	50	10	19.41	5	0	22		0	0.5	75.1	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	5	0	42.5		0	0.5	122.4	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	5	0	22		0	0.5	75.1	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B30-99

	TEST DEPTH		TEST	DEPTH T	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	50	40	10	19.41	5	0	17		0	0.5	63.6	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	5	0	32.5		0	0.5	99.4	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	5	0	17		0	0.5	63.6	
						0				1		
						0				2		
						0				3		
						0				5		
	40	30	10	19.41	3	0	0		0	0.5	22.4	Water
						0				1		flowing
						0				2		out the
						0				3		top of
						0				5		hole
				19.41	3	0	0		0	0.5	22.4	
						0				1		
						0				2		
						0				3		
						0				5		
				19.41	3	0	0		0	0.5	22.4	
						0				1		
						0				2		
						0				3		
						0				5		

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B36-99	61	50	11	13.49	5.3	0	31	0.124	0	0.5	90.3	Single
3/1/99						0				1		Packer
						0				2		until
						0				3		noted
						0				5		
				13.49	5.3	0	62		0	0.5	161.8	
						0				1		
						0				2		
						0				3		
						0				5		
				13.49	5.3	0	31		0	0.5	90.3	
						0				1		
						0				2		
						0				3		
						0				5		
	50	40	10	13.49	5.3	3	52		0	0.5	138.7	
						0.5				1		
						2.5				2		
						3.5				3		
						2.5				5		
				13.49	5.3	1	52		0	0.5	138.7	
						2				1		
						2				2		
						2.5				3		
						5.5				5		
	40	30	10	13.49	5.3	0	21		0	0.5	67.2	Began
						0				1		using
						0				2		Double
						0				3		Packer
						0				5		
				13.49	5.3	0	42		0	0.5	115.6	
						0				1		
						0				2		
						0				3		
						0				5		
				13.49	5.3	0	21		0	0.5	67.2	
						0				1		
						0				2		
						0				3		
						0				5		
	30	20	10	13.49	5.3	0	16		0	0.5	55.7	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B36-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
				13.49	5.3	0.5	32		0	0.5	92.6	
						0.5				1		
						0				2		
						0				3		
						0				5		
				13.49	5.3	0	16		0	0.5	55.7	
						0				1		
						0.5				2		
						0				3		
						0.25				5		

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B42-99	60	50	10	6.34	6	0	28	0.124	0	0.5	76.9	Single
2/16/99						0				1		Packer
						0				2		for all
						0				3		intervals
						0				5		except
												15-20 ft.
				6.34	6	0	55		0	0.5	139.2	
						0				1		
						0				2		
						0				3		
						0				5		
				6.34	6	0	28		0	0.5	76.9	
						0				1		
						0				2		
						0				3		
						0				5		
	50	40	10	6.34	6	0	23		0	0.5	65.4	
						0				1		
						0				2		
						0				3		
						0				5		
				6.34	6	0	45		0	0.5	116.1	
						0				1		
						0				2		
						0				3		
						0				5		
				6.34	6	0	23		0	0.5	65.4	
						0				1		
						0				2		
						0				3		
						0				5		
	40	30	10	6.34	5	0	18		0	0.5	52.8	
						0				1		
						0				2		
						0				3		
						0				5		
				6.34	5	0	35		0	0.5	92.1	
						0				1		
						0				2		
						0				3		
						0				5		
				6.34	5	0	18		0	0.5	52.8	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B42-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	30	20	10	6.34	5	2	25		0	0.5	69.0	
						2				1		
						4				2		
						4				3		
						8				5		
				6.34	5	4	25		0	0.5	69.0	
						4				1		
						8				2		
						8				3		
						16				5		
	20	15	5	6.34	3	0	9		0	0.5	30.1	Double
						0				1		Packer
						0				2		
						0				3		
						0				5		
				6.34	3	0	17		0	0.5	48.5	
						0				1		
						0				2		
						0				3		
						0				5		
				6.34	3	0	9		0	0.5	30.1	
						0				1		
						0				2		
						0				3		
						0				5		

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B45-99	55	45	10	11.44	5	0	23	0.124	0	0.5	69.5	Single
2/10/99						0				1		Packer
						0				2		for all
						0				3		intervals
						0				5		
				11.44	5	0	45		0	0.5	120.2	
						0				1		
						0				2		
						0				3		
						0				5		
				11.44	5	0	23		0	0.5	69.5	
						0				1		
						0				2		
						0				3		
						0				5		
	45	35	10	11.44	5	0	18		0	0.5	57.9	
						0				1		
						0				2		
						0				3		
						0				5		
				11.44	5	0	35		0	0.5	97.2	
						0				1		
						0				2		
						0				3		
						0				5		
				11.44	5	0	18		0	0.5	57.9	
						0				1		
						0				2		
						0				3		
						0				5		
	35	25	10	11.44	5	0	13		0	0.5	46.4	
						0				1		
						0				2		
						0				3		
						0				5		
				11.44	5	0	25		0	0.5	74.1	
						0				1		
						0				2		
						0				3		
						0				5		
				11.44	5	0	13		0	0.5	46.4	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B45-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	25	15	10	11.44	5	0	8		0	0.5	34.9	Water
						0				1		flowing
						0				2		out the
						0				3		top of
						0				5		hole
				11.44	5	0	15		0	0.5	51.0	
						0				1		
						0				2		
						0				3		
						0				5		
				11.44	5	0	8		0	0.5	34.9	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B50-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
MG-B50-99	80	70	10	8.26	2.5	1.5	75	0.124	0	0.5	183.7	Single
2/16/99						1.5				1		Packer
						2.7				2		
						2.5				3		
						5				5		
				8.26	2.5	1.1	75		0	0.5	183.7	
						1				1		
						2.2				2		
						2				3		
						3.9				5		
	70	60	10	8.26	2.5	10	65		0	0.5	160.7	Double
						10.6				1		Packer
						22				2		
						21.4				3		
						42.2				5		
				8.26	2.5	10.6	65		0	0.5	160.7	
						10.6				1		
						20.2				2		
						20				3		
						37.2				5		
	60	50	10	8.26	2.5	9.2	55		0	0.5	137.6	
						9.2				1		
						18.6				2		
						19				3		
						36.4				5		
				8.26	2.5	9.8	55		0	0.5	137.6	
						10				1		
						19.2				2		
						19.2				3		
						37.4				5		
	50	40	10	8.26	2.5	0.7	45		0	0.5	114.5	
						0.9				1		
						1.2				2		
						1				3		
						2.2				5		
				8.26	2.5	0.2	45		0	0.5	114.5	
						0.3				1		
						0.5				2		
						0.7				3		
						1.8				5		
	40	30	10	8.26	2.5	0	35		0	0.5	91.5	
						0				1		
						0				2		
						0				3		
						0				5		
				8.26	2.5	0	35		0	0.5	91.5	
						0				1		
						0				2		
						0				3		
						0				5		

MG-B50-99

	TEST DEPTH		TEST	DEPTH TO	GAUGE	WATER	GAUGE	HOLE	FRICT.	TEST	TOTAL	
	FROM	TO	LENGTH	WATER	HEIGHT	TAKE	PRESS.	RADIUS	LOSS	TIME	HEAD	REMARKS
BORING	(ft.)		(ft.)	(ft.)	(ft.)	(gal)	(psi)	(ft.)	(psi)	(min.)	(ft.)	
	30	20	10	8.26	2.5	0.2	25		0	0.5	68.4	
						0.2				1		
						0.4				2		
						0.4				3		
						0.9				5		
				8.26	2.5	0.1	25		0	0.5	68.4	
						0.1				1		
						0.4				2		
						0.4				3		
						0.7				5		

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX I

SLUG TEST DATA

THIS PAGE INTENTIONALLY LEFT BLANK

Croton WTP Final Design
Mosholu Golf Course - Slug Test Results
Well MG-B51-99

TEST	HVORSLEV SLUG TEST ANALYSIS		BOUWER & RICE SLUG TEST ANALYSIS	
Falling Head No. 1	4.66E-01 ft/day	3.24E-04 ft/min	4.50E-01 ft/day	3.13E-04 ft/min
Rising Head No.1	3.37E-01 ft/day	2.34E-04 ft/min	3.76E-01 ft/day	2.61E-04 ft/min
Falling Head No. 2	5.30E-01 ft/day	3.68E-04 ft/min	5.55E-01 ft/day	3.85E-04 ft/min
Rising Head No.2	3.61E-01 ft/day	2.51E-04 ft/min	4.42E-01 ft/day	3.07E-04 ft/min
Falling Head No. 3	5.17E-01 ft/day	3.59E-04 ft/min	4.84E-01 ft/day	3.36E-04 ft/min
Rising Head No.3	3.94E-01 ft/day	2.74E-04 ft/min	4.65E-01 ft/day	3.23E-04 ft/min
Average Falling Head Test Result	5.04E-01 ft/day	3.50E-04 ft/min	4.96E-01 ft/day	3.45E-04 ft/min
Average Rising Head Test Result	3.64E-01 ft/day	2.53E-04 ft/min	4.28E-01 ft/day	2.97E-04 ft/min
Average Rising & Falling Head Results by Method	4.34E-01 ft/day	3.02E-04 ft/min	4.62E-01 ft/day	3.21E-04 ft/min
Average of All Test Results, Both Methods	**4.48E-01 ft/day**	**3.11E-04 ft/min**		

MOSHOLU GOLF COURSE SLUG TEST

Well Statistics

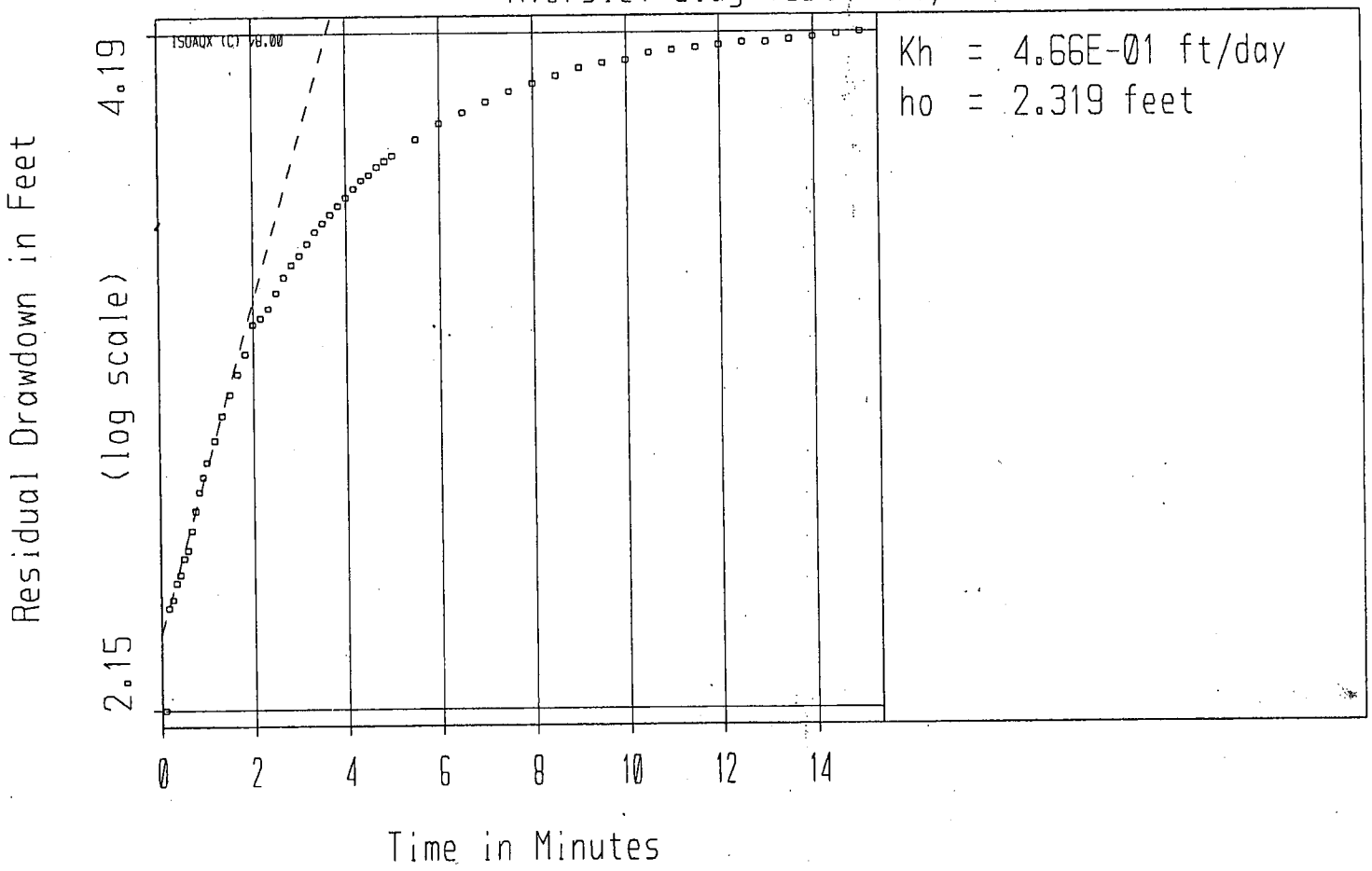
Well Id = **MG-B51-99**
Well diameter = 2 inch schedule 40 PVC 20 slot screen
Well screen interval = 8.0' to 16.0' (8 feet screen length)
Well annular space diameter = 3.5" (NW casing used to set well)
Slug displacement volume = 0.45 gallons

Elapsed Time min:sec	Falling Head #1 feet	Rising Head #1 feet	Falling Head #2 feet	Rising Head #2 feet	Falling Head # 3 feet	Rising Head # 3 feet
0:00	4.23	4.23	4.23	4.23	4.23	4.23
0:05	2.15	6.35	2.23	6.36	2.27	6.36
0:10	2.38	6.30	2.28	6.22	2.30	6.31
0:15	2.40	6.19	2.35	6.15	2.33	6.20
0:20	2.44	6.12	2.39	6.10	2.39	6.13
0:25	2.46	6.07	2.45	6.01	2.44	6.05
0:30	2.50	6.02	2.49	6.00	2.49	6.00
0:35	2.52	5.97	2.53	5.94	5.52	5.96
0:40	2.57	5.92	2.58	5.90	2.56	5.92
0:45	2.62	5.89	2.62	5.87	2.61	5.88
0:50	2.67	5.85	2.66	5.83	2.65	5.84
0:55	2.71	5.81	2.70	5.79	2.69	5.81
1:00	2.75	5.77	2.74	5.76	2.72	5.77
1:10	2.81	5.68	2.79	5.68	2.80	5.71
1:20	2.88	5.62	2.86	5.64	2.86	5.64
1:30	2.94	5.55	2.93	5.57	2.94	5.56
1:40	3.00	5.49	2.99	5.50	2.98	5.51
1:50	3.06	5.43	3.06	5.44	3.05	5.45
2:00	3.15	5.38	3.11	5.37	3.10	5.39
2:10	3.17	5.33	3.16	5.32	3.15	5.34
2:20	3.20	5.27	3.20	5.27	3.20	5.28
2:30	3.25	5.23	3.25	5.22	3.24	5.24
2:40	3.30	5.18	3.30	5.18	3.28	5.19
2:50	3.34	5.14	3.34	5.14	3.33	5.15
3:00	3.37	5.10	3.37	5.10	3.36	5.11
3:10	3.41	5.05	3.41	5.06	3.40	5.07
3:20	3.45	5.02	3.45	5.02	3.44	5.03
3:30	3.48	4.98	3.49	4.98	3.47	5.00
3:40	3.51	4.95	3.52	4.95	3.51	4.97
3:50	3.54	4.93	3.55	4.92	3.54	4.93
4:00	3.57	4.89	3.58	4.89	3.57	4.90
4:10	3.60	4.86	3.61	4.86	3.60	4.87
4:20	3.63	4.83	3.64	4.83	3.63	4.85
4:30	3.65	4.81	3.66	4.81	3.65	4.82
4:40	3.68	4.78	3.69	4.78	3.67	4.78
4:50	3.70	4.75	3.71	4.75	3.70	4.76
5:00	3.72	4.73	3.73	4.73	3.72	4.74
5:30	3.78	4.67	3.79	4.67	3.78	4.68
6:00	3.84	4.62	3.84	4.62	3.83	4.62
6:30	3.88	4.57	3.89	4.57	3.88	4.57
7:00	3.92	4.52	3.93	4.53	3.92	4.53
7:30	3.96	4.49	3.97	4.49	3.95	4.50
8:00	3.99	4.46	4.00	4.46	3.99	4.46
8:30	4.02	4.43	4.02	4.43	4.01	4.44
9:00	4.05	4.41	4.04	4.41	4.03	4.41
9:30	4.07	4.39	4.07	4.39	4.05	4.39
10:00	4.08	4.37	4.08	4.37	4.07	4.37
10:30	4.11	4.35	4.10	4.35	4.09	4.35
11:00	4.12	4.34	4.12	4.34	4.10	4.34
11:30	4.13	4.33	4.13	4.32	4.12	4.33
12:00	4.14	4.32	4.14	4.32	4.13	4.31
12:30	4.15	4.31	4.15	4.31	4.14	4.30
13:00	4.15	4.30	4.16	4.30	4.15	4.29
13:30	4.16	4.29	4.16	4.29	4.16	4.29
14:00	4.17	4.28	4.17	4.28	4.16	4.28
14:30	4.18	4.28	4.17	4.28	4.17	4.27
15:00	4.19	4.27	4.18	4.27	4.18	4.26

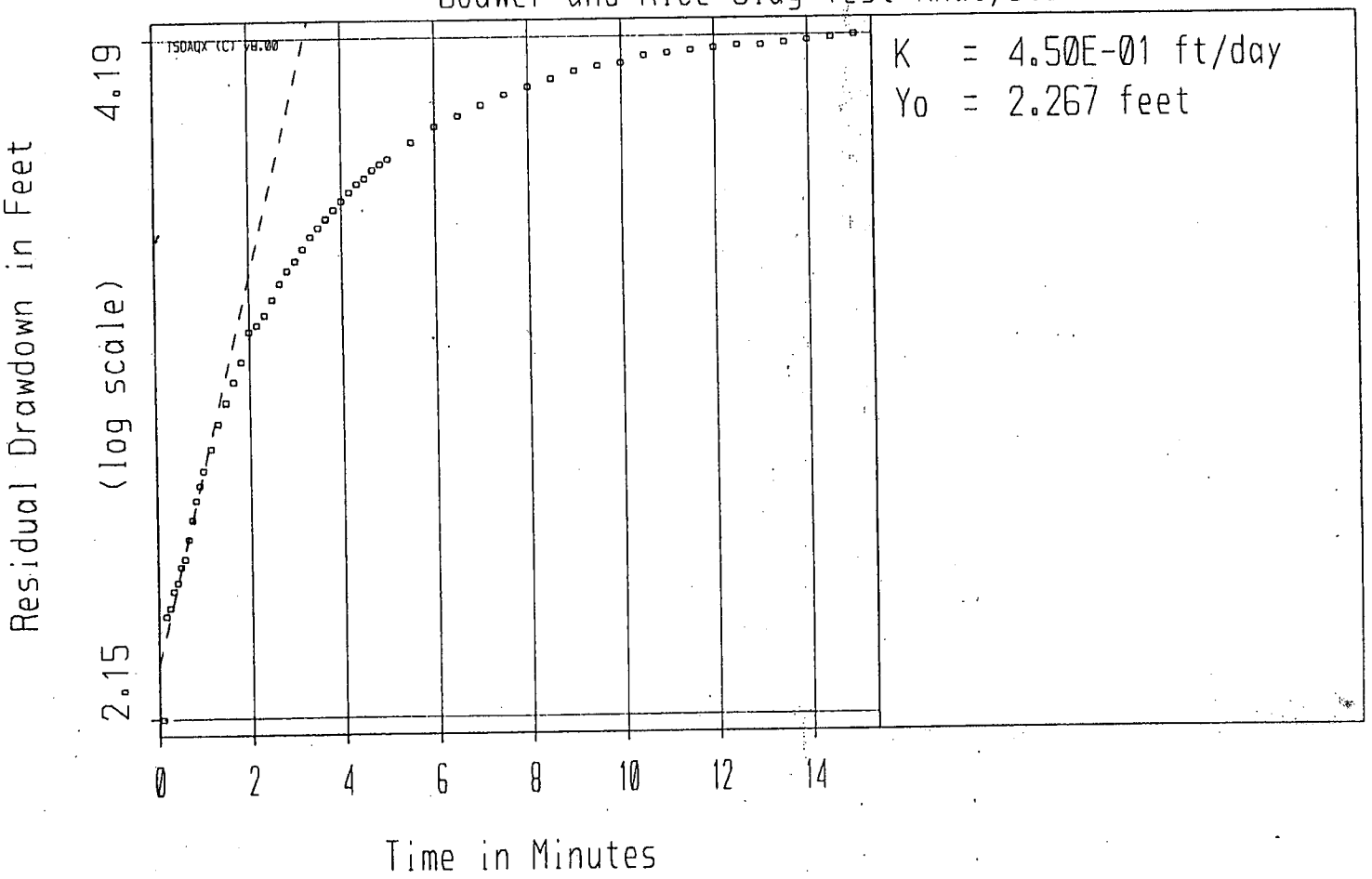
Mosholu Golf Course Slug Testing

Well MG-B51-99 - Falling Head Test No. 1

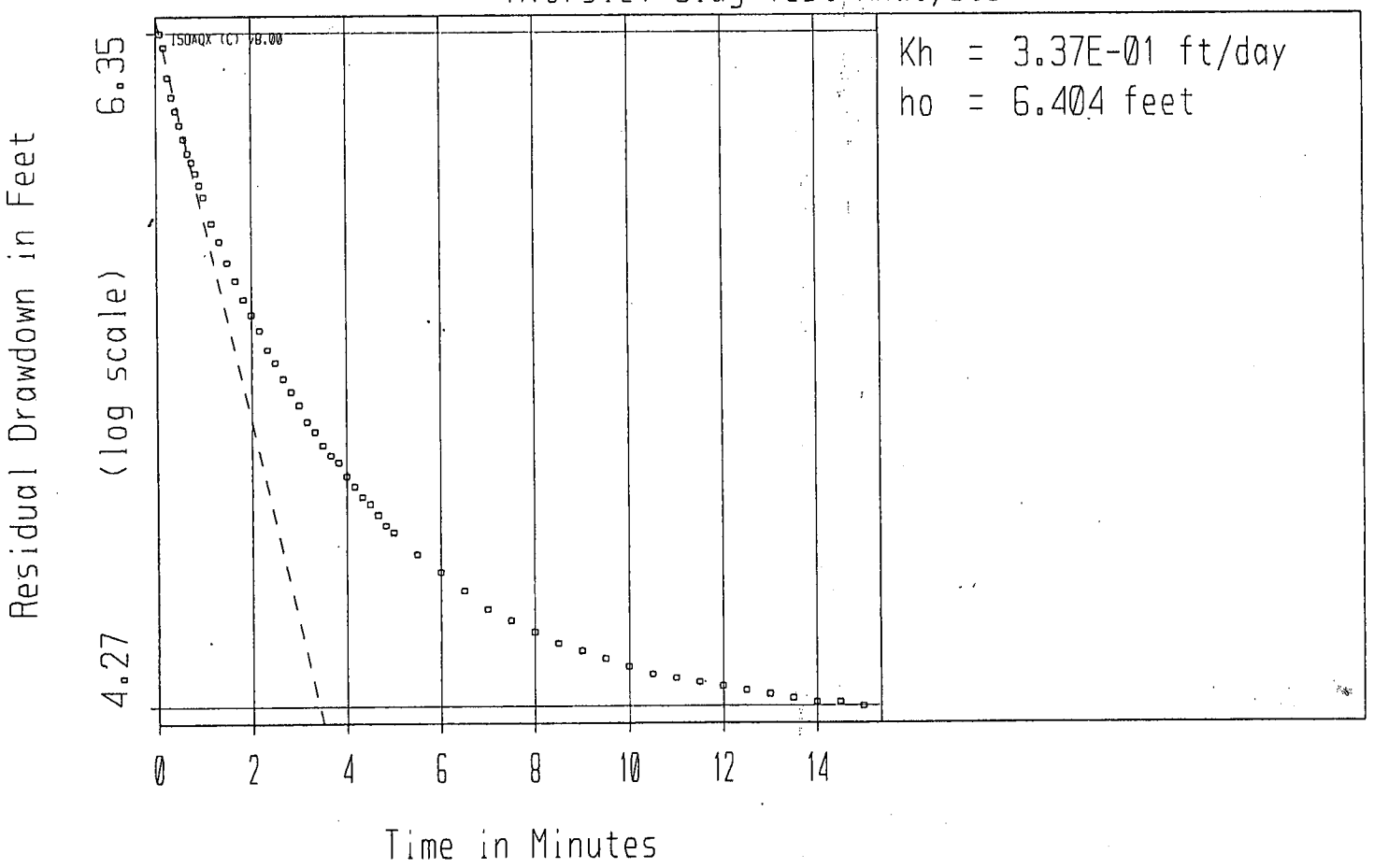
Hvorslev Slug Test Analysis



Mosholu Golf Course Slug Testing
Well MG-B51-99 - Falling Head Test No. 1
Bouwer and Rice Slug Test Analysis



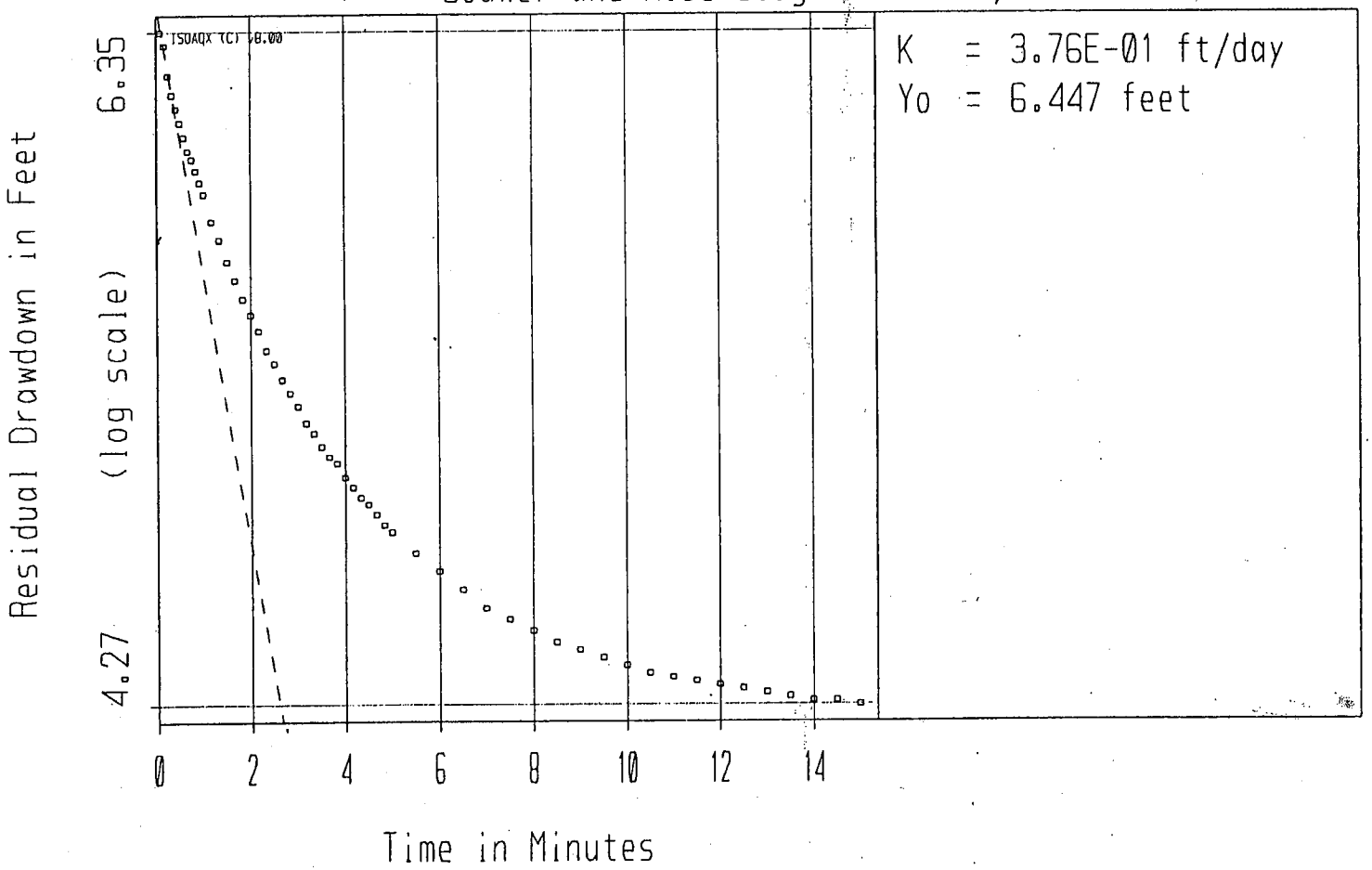
Mosholu Golf Course Slug Testing
Well MG-B51-99 - Rising Head Test No. 1
Hvorslev Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Rising Head Test No. 1

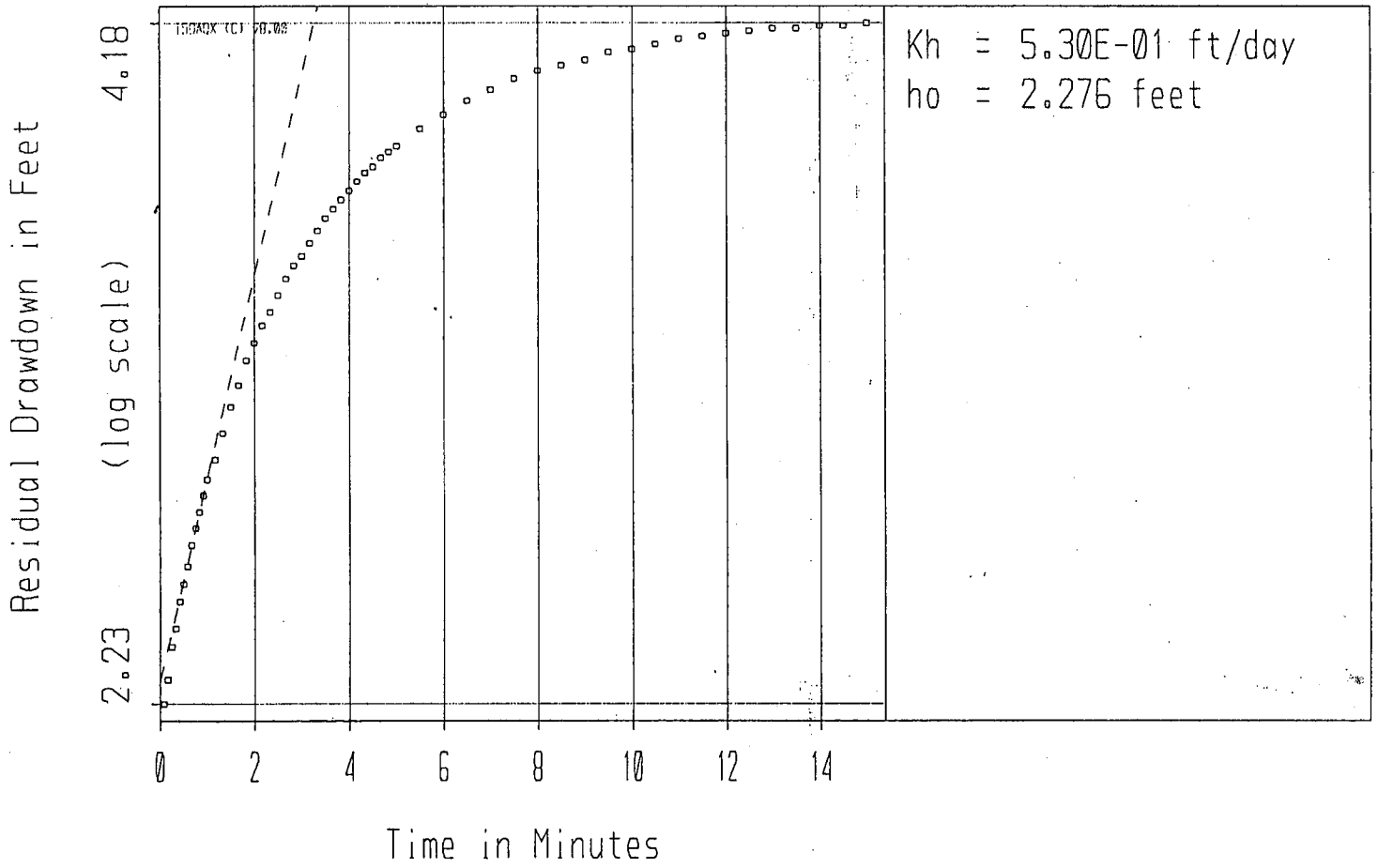
Bouwer and Rice Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Falling Head Test No. 2

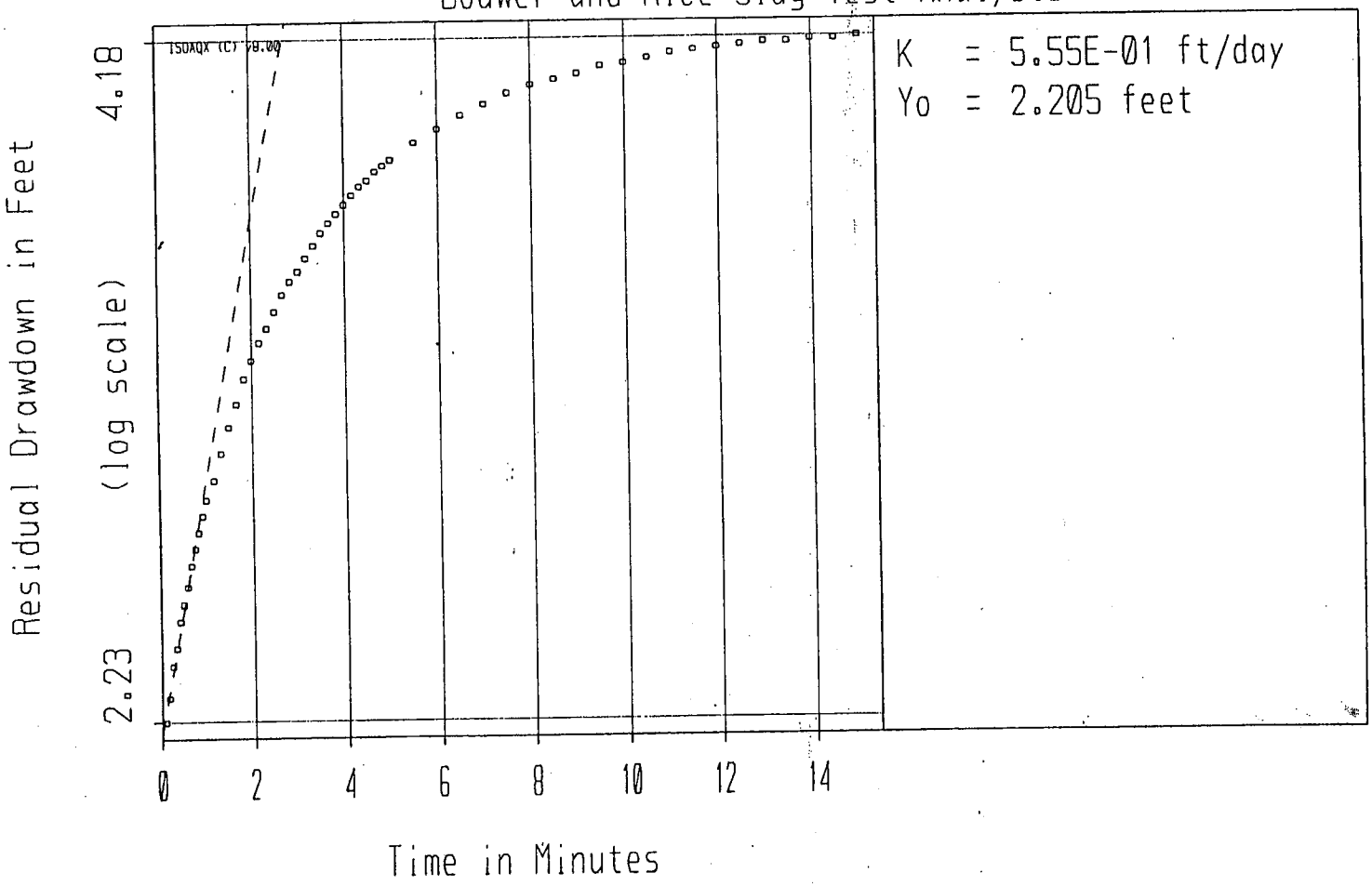
Hvorslev Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Falling Head Test No. 2

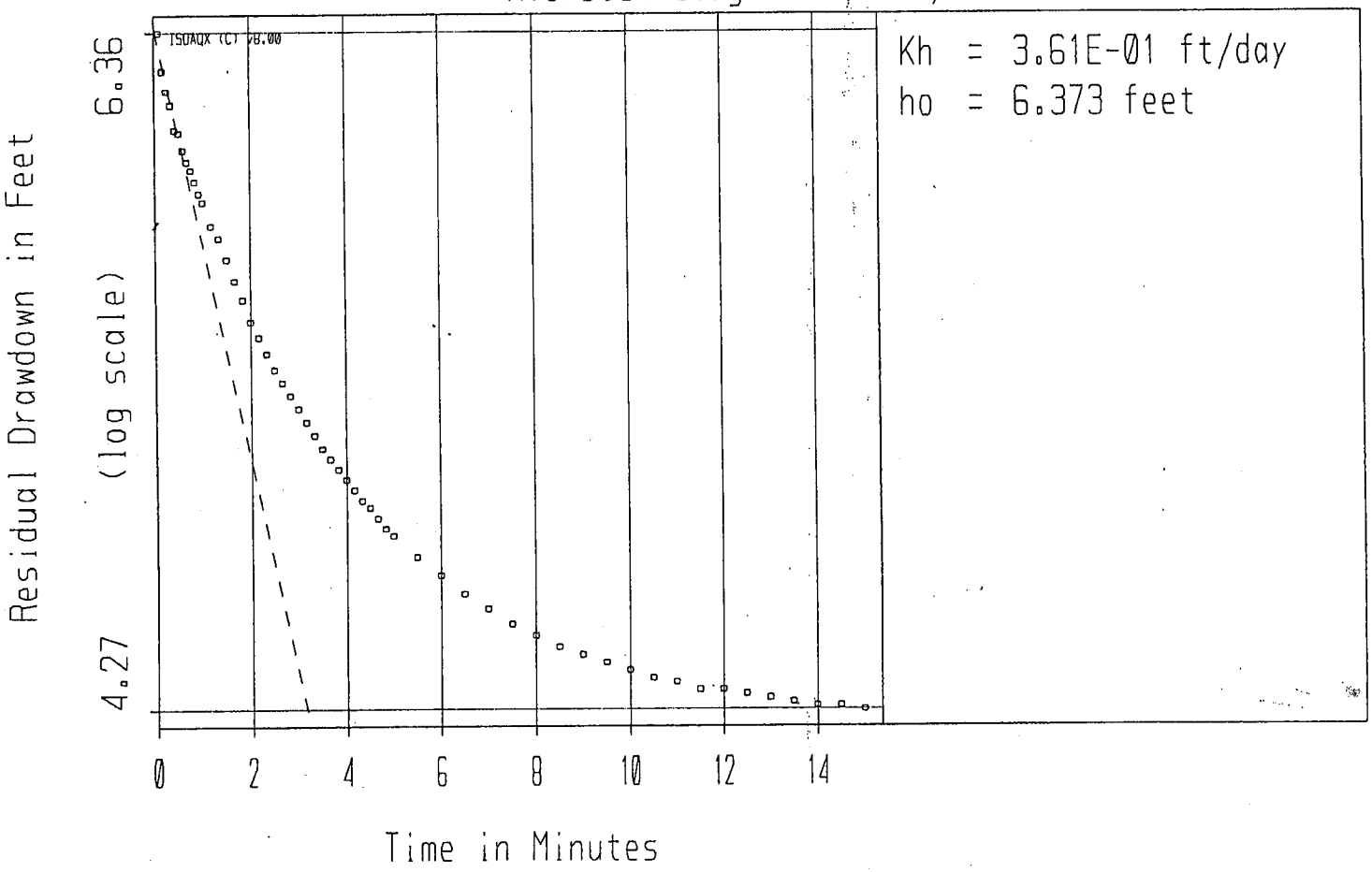
Bouwer and Rice Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Rising Head Test No. 2

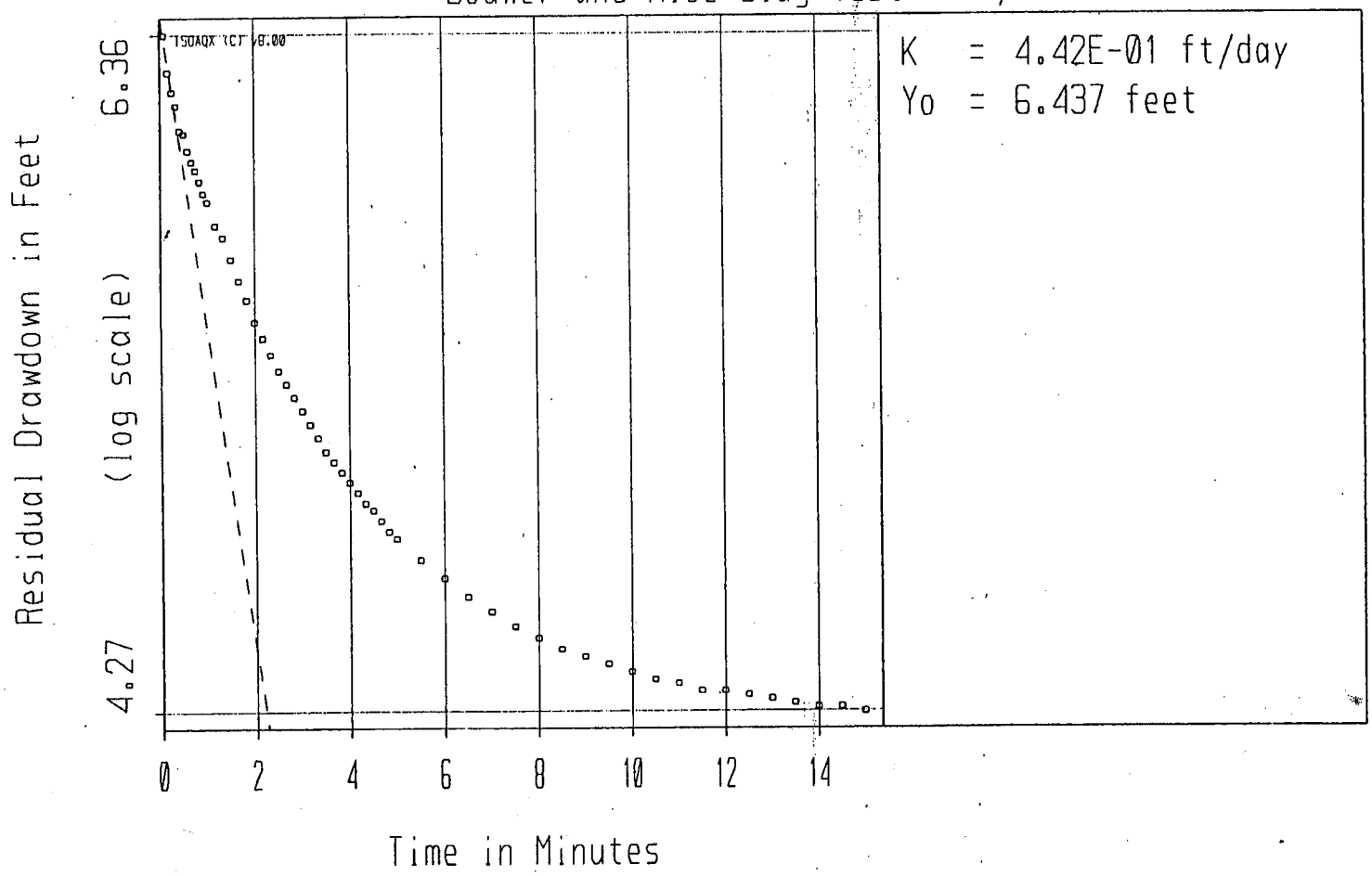
Hvorslev Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Rising Head Test No. 2

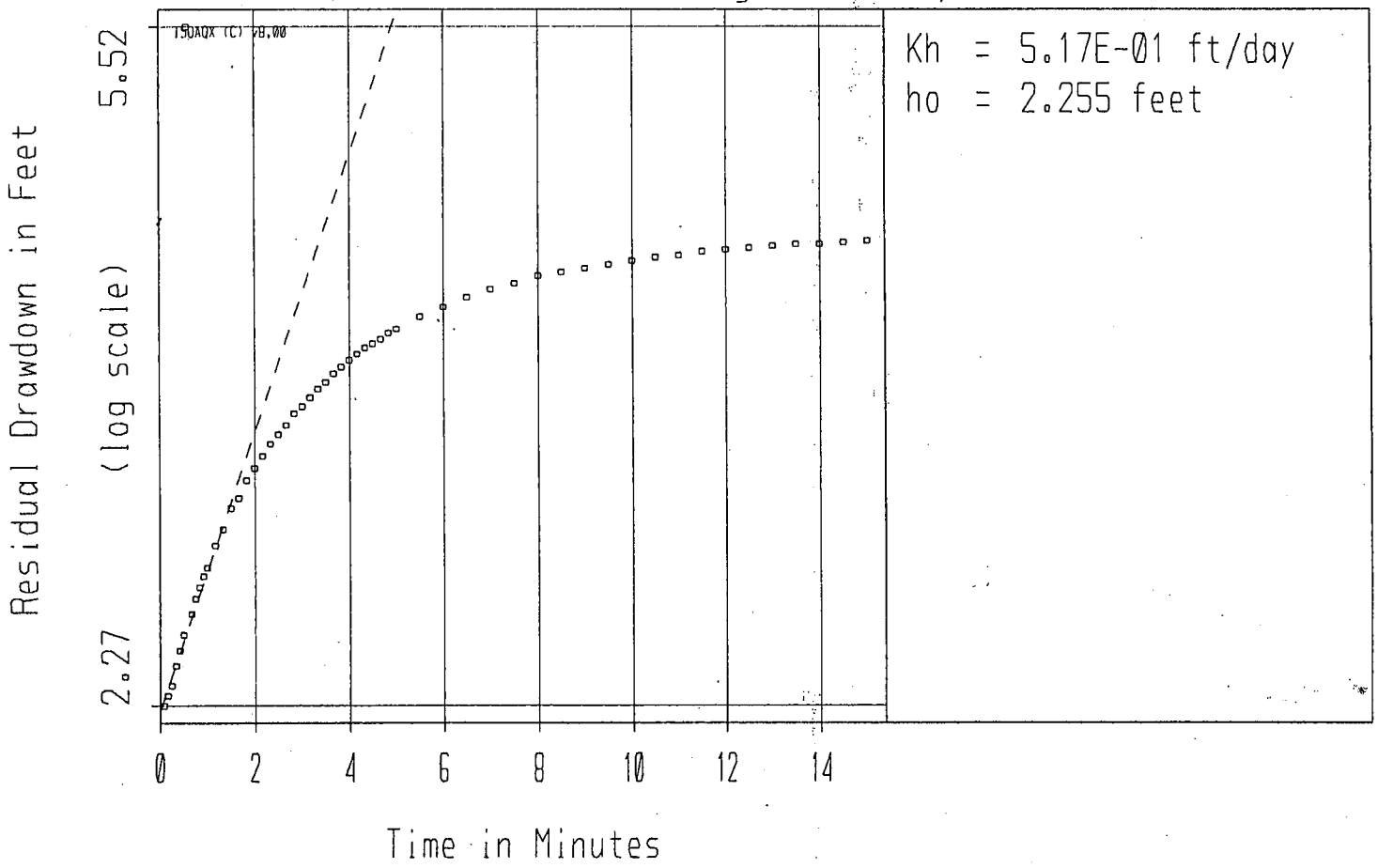
Bouwer and Rice Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Falling Head Test No. 3

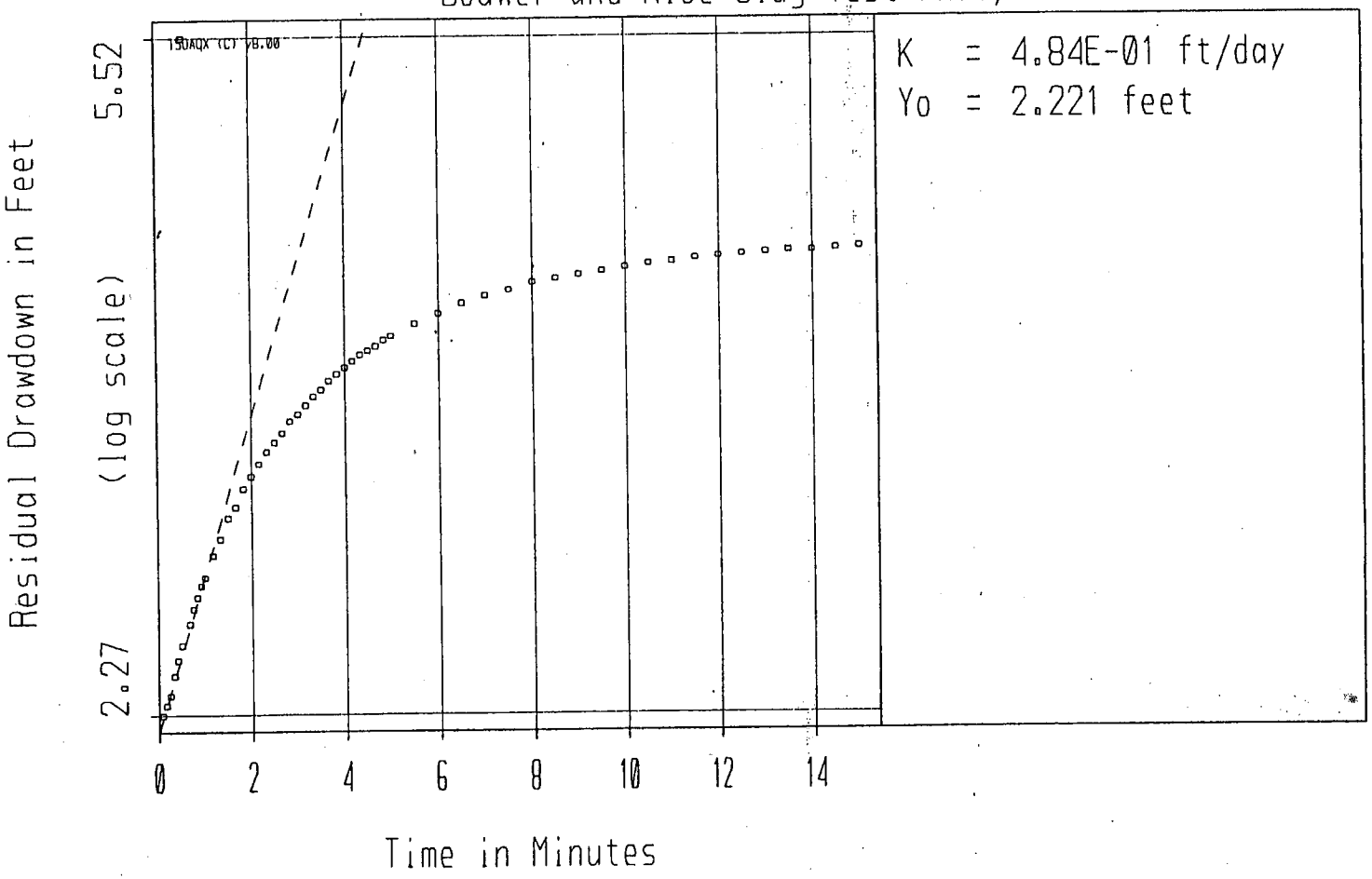
Hvorslev Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Falling Head Test No. 3

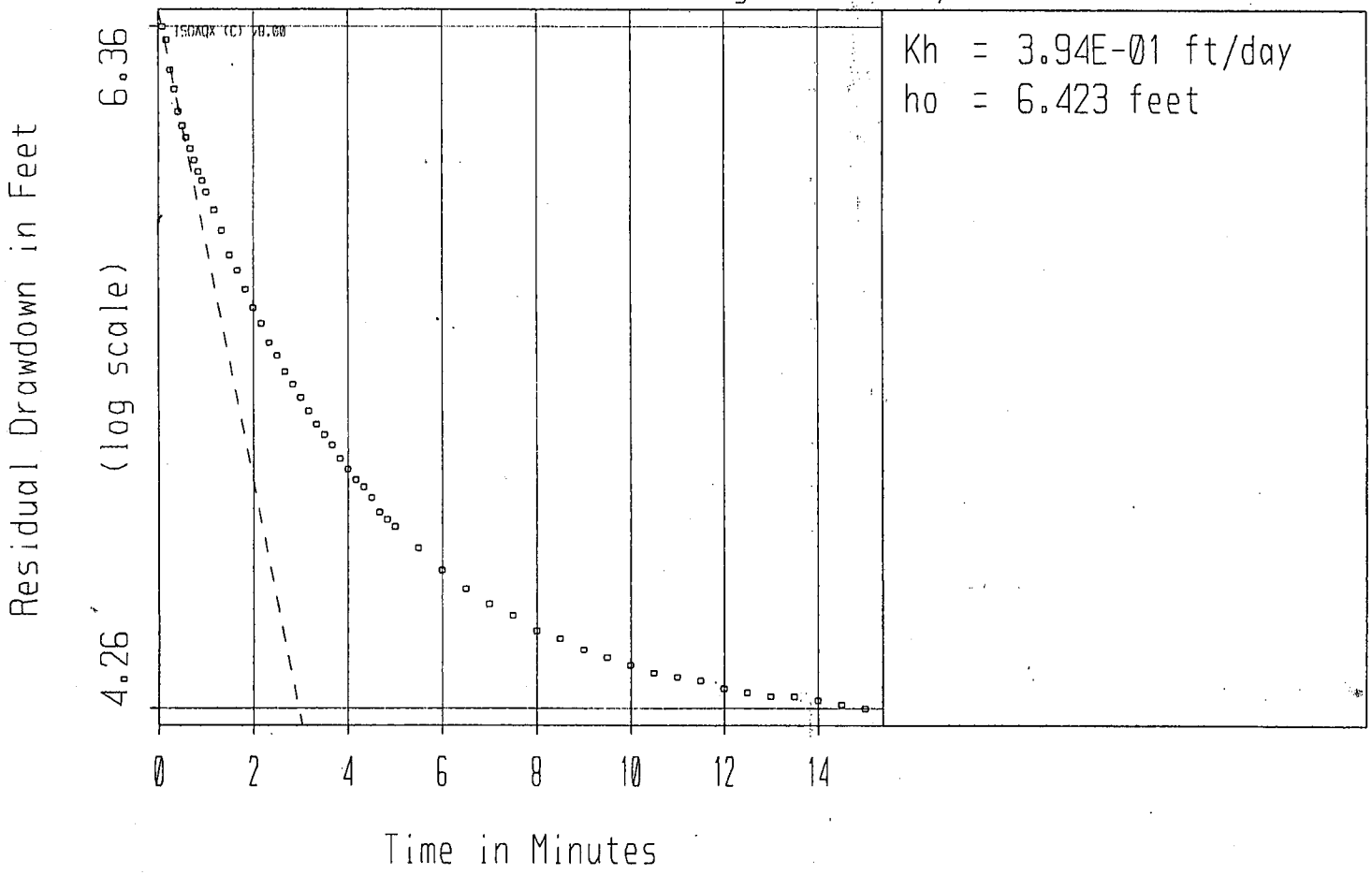
Bouwer and Rice Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Rising Head Test No. 3

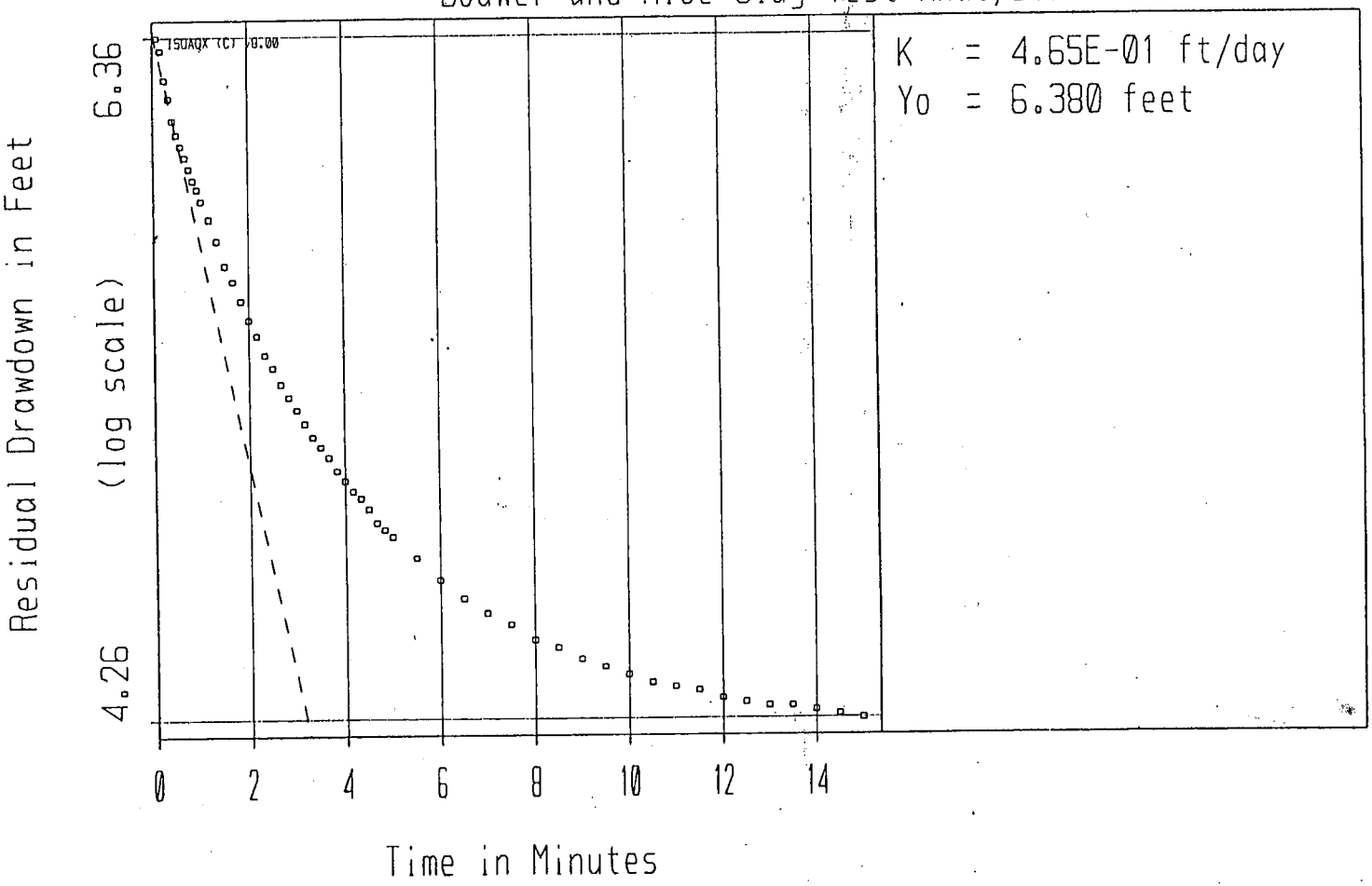
Hvorslev Slug Test Analysis



Mosholu Golf Course Slug Testing

Well MG-B51-99 - Rising Head Test No. 3

Bouwer and Rice Slug Test Analysis



APPENDIX J

LABORATORY SOIL AND ROCK TEST RESULTS

THIS PAGE INTENTIONALLY LEFT BLANK

Soil

THIS PAGE INTENTIONALLY LEFT BLANK

long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713

LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

Report No.: 4
Date: April 19, 1999

Client: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.
Project: CROTON WATER TREATMENT PLANT - HED-543
(MOSHOLU GOLF COURSE @ VAN CORTLANDT PARK - Bronx, N.Y.)
Subject: ANALYSIS OF SOIL BORING SAMPLES

Date Samples Rec'd.: March 17, 1999 (P.M.) Sampled By: Client
Pick-Up/Delivery By: LIMTL, Inc.

In accordance with your request and direction, soil boring samples were picked up by our personnel and delivered to our laboratory facility for testing. Tests were performed as per report.

MECHANICAL ANALYSIS (ASTM D-422)/MOISTURE CONTENT (ASTM D-2216)/SPECIFIC GRAVITY (ASTM D-854)

Sample Identification	MG-B1-99	MG-B6-99	MG-B10-99	MG-B22-99	MG-B22-99	MG-B25-99
Sample No.	SS-5	SS-4	SS-3	SS-6	SS-8	SS-3
Depth	(8'-10')	(6'-8')	(4'-6')	(10'-10.4')	(20'-22')	(4'-6')
Passing, 2" Sieve	100%	100%	100%	100%	100%	100%
Passing, 1" Sieve	100	100	90.1	100	100	87.5
Passing, 1/2" Sieve	83.1	77.9	87.3	100	89.7	86.2
Passing, 3/8" Sieve	82.4	75.2	83.6	94.1	88.2	81.8
Passing, # 4 Sieve	76.2	70.3	71.7	89.3	85.8	76.0
Passing, # 16 Sieve	67.6	58.8	58.3	80.3	68.7	64.1
Passing, # 50 Sieve	46.1	33.4	33.8	47.0	38.5	35.9
Passing, #100 Sieve	27.9	17.2	20.6	27.1	23.5	20.8
Passing, #200 Sieve	15.1	17.1	13.7	14.6	12.8	10.6
Moisture Content (As Rec'd.)	9.5%	2.1%	-	-	-	12.2%

Sample Identification	MG-B26-99	MG-B26-99	MG-B27-99	MG-B27-99	MG-B28-99
Sample No.	SS-4	SS-8	SS-6	SS-10	SS-5
Depth	(6'-8')	(33.5')	(14'-16')	(22'-24')	(8'-10')
Passing, 2" Sieve	100%	100%	100%	100%	100%
Passing, 1" Sieve	81.9	100	100	100	100
Passing, 1/2" Sieve	81.9	100	96.8	100	98.7
Passing, 3/8" Sieve	81.4	100	91.3	100	97.7
Passing, # 4 Sieve	77.4	99.5	88.5	95.1	93.6
Passing, # 16 Sieve	71.2	89.8	83.3	88.5	80.6
Passing, # 50 Sieve	45.7	60.6	70.6	57.5	44.1
Passing, #100 Sieve	27.8	31.0	43.1	28.9	23.1
Passing, #200 Sieve	16.4	11.1	15.3	10.7	10.9
Moisture Content (As Rec'd.)	-	27.6%	-	-	-
Specific Gravity	-	2.72	-	-	-

RECEIVED
APR 22 1999

Sample Identification	MG-B30-99	MG-B30-99	MG-B31-99	MG-B33-99	MG-B35-99	MG-B35-99
Sample No.	SS-4	SS-6	SS-5	SS-4	SS-4	SS-6
Depth	(6'-8')	(16.3'-18.3')	(8'-10')	(7'-9')	(6'-8')	(10'-12')
Passing, 2" Sieve	100%	100%	100%	100%	100%	100%
Passing, 1" Sieve	98.1	100	100	100	100	100
Passing, 1/2" Sieve	81.3	93.8	96.2	96.5	75.2	97.6
Passing, 3/8" Sieve	72.6	83.6	91.7	96.5	75.2	88.4
Passing, # 4 Sieve	68.1	81.5	87.6	96.5	71.8	76.3
Passing, # 16 Sieve	66.3	74.6	72.4	96.0	65.0	61.7
Passing, # 50 Sieve	39.6	63.2	41.9	76.2	44.0	45.3
Passing, #100 Sieve	18.9	37.2	24.3	63.1	22.6	30.7
Passing, #200 Sieve	10.8	12.5	11.4	42.6	11.2	12.9
Moisture Content (As Rec'd.)	7.3%	-	8.7	-	-	-

Sample Indentification	MG-B36-99	MG-B39-99	MG-B48-99	MG-B48-99	MG-B49-99	MG-B49-99
Sample No.	SS-6	SS-8	SS-6	SS-10	SS-5	SS-7
Depth	(10'-12')	(14-16')	(10'-12')	(21'-23')	(8'-10')	(20'-22')
Passing, 2" Sieve	100%	100%	100%	100%	100%	100%
Passing, 1" Sieve	100	100	100	100	100	100
Passing, 1/2" Sieve	100	91.0	100	97.0	91.4	73.6
Passing, 3/8" Sieve	98.9	88.8	98.1	95.2	84.3	72.1
Passing, # 4 Sieve	95.8	87.8	94.0	90.6	72.8	64.3
Passing, # 16 Sieve	88.3	86.8	80.3	83.1	63.2	53.1
Passing, # 50 Sieve	59.1	75.7	58.4	57.4	41.8	32.2
Passing, #100 Sieve	32.7	42.5	41.7	37.3	21.7	19.1
Passing, #200 Sieve	16.9	12.9	26.7	20.7	9.3	9.8
Moisture Content (As Rec'd.)	-	10.0%	37.3%	10.8%	-	10.0%
Specific Gravity	-	2.67	-	2.72	-	2.71

Sample Identification	MG-B43-99	MG-B43-99	MG-B47-99
Sample No.	SS-4	SS-6	SS-4
Depth	(6'-8')	(10'-12')	(6'-8')
Passing, 2" Sieve	100%	100%	100%
Passing, 1" Sieve	100	100	67.0
Passing, 1/2" Sieve	80.1	100	60.8
Passing, 3/8" Sieve	76.5	100	60.8
Passing, # 4 Sieve	69.8	99.7	56.1
Passing, # 16 Sieve	63.1	90.5	43.2
Passing, # 50 Sieve	38.9	46.7	23.6
Passing, #100 Sieve	19.8	21.2	19.8
Passing, #200 Sieve	11.1	8.5	7.0
Moisture Content (As Rec'd.)	-	-	8.4%

Sample Identification	MG-TP1-99	MG-TP4-99	MG-TP6-99	MG-TP7-99		
Sample No.	-	-	-	-		
Depth	7.5'	10'	10'	9'		
Passing, 2" Sieve	100%	100%	100%	100%		
Passing, 1" Sieve	97.9	94.5	98.1	98.7		
Passing, 1/2" Sieve	90.7	83.2	92.3	93.1		
Passing, 3/8" Sieve	89.2	80.2	90.1	89.2		
Passing, # 4 Sieve	85.1	75.2	84.6	83.0		
Passing, # 16 Sieve	74.3	65.5	72.7	71.4		
Passing, # 50 Sieve	50.0	43.3	44.9	47.6		
Passing, #100 Sieve	34.5	30.0	24.7	33.4		
Passing, #200 Sieve	23.8	20.6	15.8	19.2		
Moisture Content (As Rec'd.)	-	-	-	-		

LAB. TECH.: M.A. Barnett (#536)

Respectfully submitted,

LONG ISLAND MATERIALS TESTING LAB., INC.

R.F. Barnett
President

RFB:jm/419
Copies: 3-client
2-acct'g.

long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713

LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

Report No.: 5
Date: April 23, 1999

Client: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.
Project: CROTON WATER TREATMENT PLANT - HED-543
(MOSHOLU GOLF COURSE @ VAN CORTLANDT PARK - Bronx, N.Y.)
Subject: ANALYSIS OF TEST PIT SAMPLE

Sample No.: MG-TP 10-99

Depth: -7.5'

MECHANICAL/HYDROMETER ANALYSIS (ASTM D-422)

Sieve Size	Sample Percent Passing
1"	100%
1/2"	100
3/8"	82.2
# 4	75.1
# 10	69.0

Particle Size	Sample Percent
0.330MM	39.26
0.220MM	32.03
0.130MM	24.80
0.095MM	18.60
0.068MM	16.53
0.048MM	14.46
0.040MM	12.91
0.034MM	12.40
0.031MM	11.36
0.028MM	11.22
0.026MM	10.85
0.025MM	10.33
0.014MM	10.26

Sample Composition

Gravel:	23.1%
Sand:	
Coarse	9.0
Medium	22.5
Fine	27.6
Silt:	9.7
Clay:	8.1

Specific Gravity: 2.62
Atterberg Limits: 32 Liquid Limit
17 Plastic Limit
15 Plasticity Index

LAB. TECH.: M.A. Barnett (#536)

Respectfully submitted,

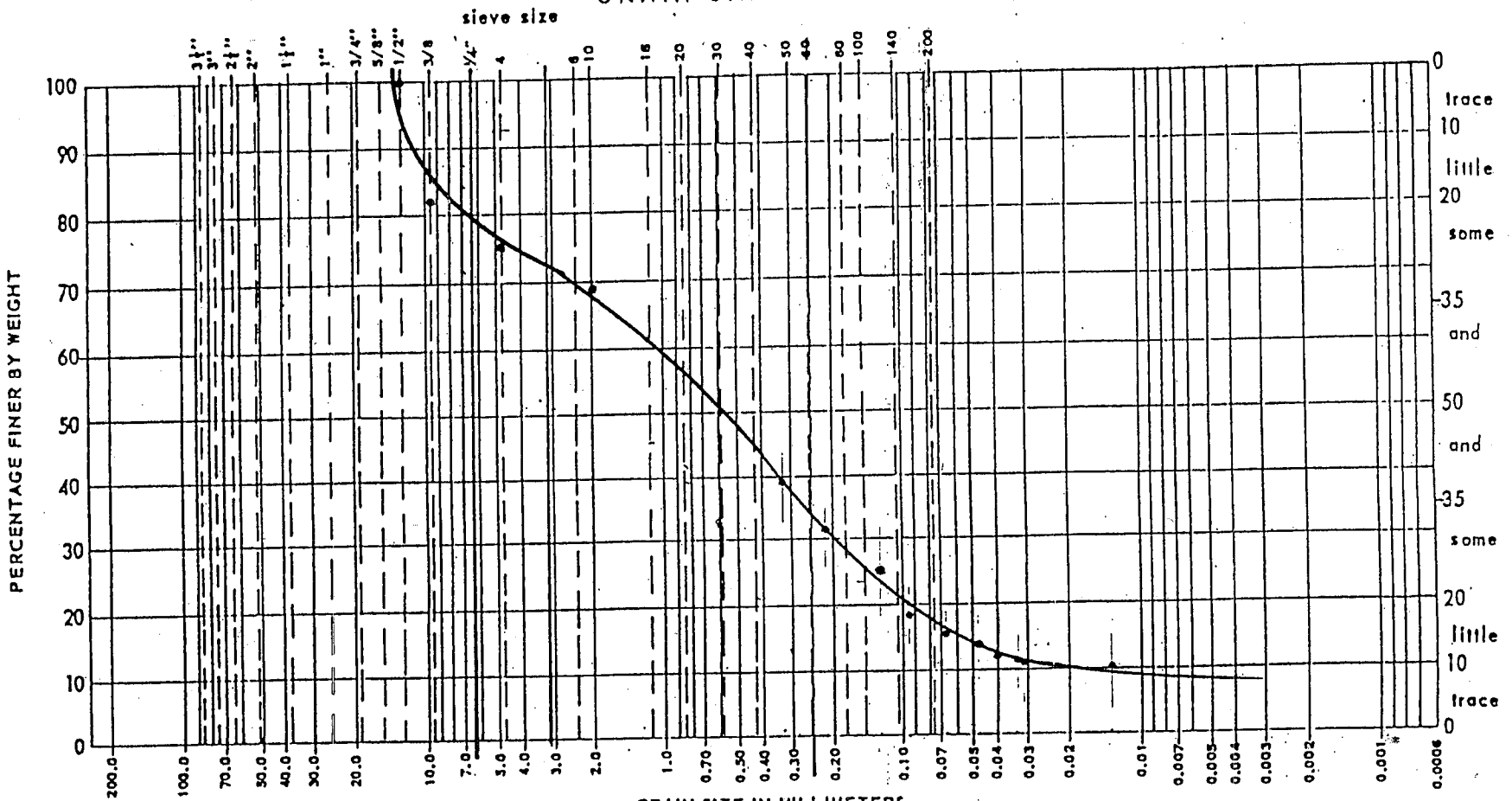
LONG ISLAND MATERIALS TESTING LAB., INC.

R.F. Barnett
President

RFB:md/426
Copies: 3-client,2-acct'g.

SAMPLE NO.: MG-TP 10-99

GRAIN SIZE ANALYSIS



Project HED-543
Sample No. TP10 Depth -7.5'
Lab. No. -
Date 4/23/99
LL 32 PL 17 PI 15
SG 2.62 R.M.A. Barnett

LOCATION _____ DESCRIPTION _____

REMARKS

THIS PAGE INTENTIONALLY LEFT BLANK

Rock

THIS PAGE INTENTIONALLY LEFT BLANK

long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713

LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

Report No.: 1
Date: April 5, 1999

Client: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.
Project: CROTON WATER TREATMENT PLANT - HED-543
(MOSHOLU GOLF COURSE @ VAN CORTLANDT PARK - Bronx, NY)
Subject: PHYSICAL TESTING OF BORING SAMPLES - ROCK & SOIL

Samples Rec'd.: March 18, 1999
Test Revision Rec'd.: March 23, 1999

Del. By: LIMTL, Inc.

UNCONFINED COMPRESSION TESTING OF ROCK CORES (ASTM D-2938)

Rock samples were catalogued, processed, prepared, and tested in accordance with ASTM D-2938 and referenced documents.

Sample Identification	MG-B1-99	MB-B2-99		MG-B6-99	MG-B7-99
Depth	74.2'-75.0'	49.0'-50.0'	81.0'-81.5'	38.0'-38.7'	82.8'-83.4'
Temperature	ROOM TEMPERATURE 72°F ± 2°F				
Moisture Content	*AS RECEIVED				
Height of Specimen(in.)	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	1.99	1.87	1.87	1.99	1.99
Area (sq.in.)	3.11	2.76	2.76	3.11	3.11
Total Load (lbs.)	30,000	42,500	44,800	63,000	61,200
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	9,646	15,399	16,232	20,257	19,678

Sample Identification	MG-B9-99	MG-B15-99	MG-B22-99	MG-B24-99	MG-B27-99
Depth	71.5'-72.0'	70.5'-71.0'	73.0'-73.6'	56.0'-57.0'	69.3'-69.8'
Temperature	ROOM TEMPERATURE 72°F ± 2°F				
Moisture Content	*AS RECEIVED				
Height of Specimen(in.)	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	1.99	1.99	1.99	1.99	1.99
Area (sq.in.)	3.11	3.11	3.11	3.11	3.11
Total Load (lbs.)	29,500	41,000	31,000	14,000	22,800
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	9,486	13,183	9,968	4,502	7,331

Sample Identification	MG-B28-99	MG-B32-99	MG-B43-99	MG-B12-99	MG-B13-99
Depth	61.8'-62.3'	29.0'-30.0'	46.1'-46.7'	79.5'-80.3'	66.9'-67.5'
Temperature	ROOM TERMPERATURE 72°F ± 2°F				
Moisture Content	*AS RECEIVED				
Height of Specimen(in.)	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	1.99	1.99	1.99	1.99	1.99
Area (sq.in.)	3.11	3.11	3.11	3.11	3.11
Total Load (lbs.)	38,000	29,300	21,600	42,500	52,500
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	12,219	9,421	6,945	13,666	16,881

Metcalf & Eddy, Inc./
Hazen & Sawyer - JV

Sample Identification	MG-B23-99	MG-B30-99	MG-B35-99	MG-B36-99	MG-B46-99
Depth	66.5'-67.5'	63.0'-63.7'	55.4'-56.1'	55.3'-56.0'	48.0'-48.8'
Temperature	ROOM TEMPERATURE 72°F ± 2°F				
Moisture Content	*AS RECEIVED				
Height of Specimen(in.)	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	1.99	1.99	1.99	1.99	1.99
Area (sq.in.)	3.11	3.11	3.11	3.11	3.11
Total Load (lbs.)	37,000	42,800	42,000	26,300	29,100
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	11,897	13,762	13,505	8,457	9,357

*Random moisture tests taken yielded contents of dry to 0.39%.
Fracture sketches attached.

LABORATORY TECH.: M.A. Barnett (#536)

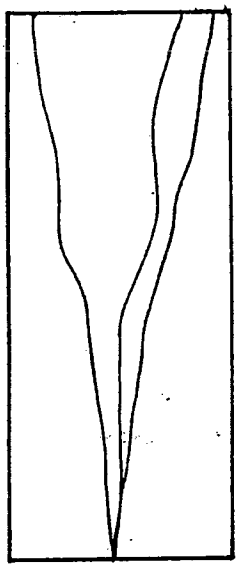
Respectfully submitted,
LONG ISLAND MATERIALS TESTING LAB., INC.

R.F. Barnett
President

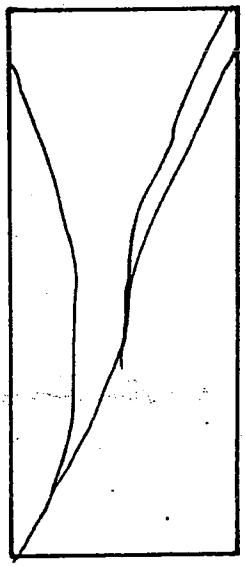
RFB:md/406
Copies: 3-client
2-acct'g.

UNCONFINED COMPRESSION TESTS - FRACTURE LINES
(ROCK CORES)

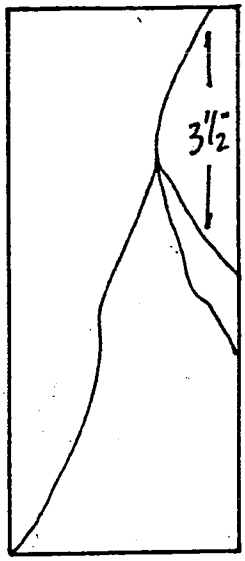
MG·B1·99
(74.2'-75.0')



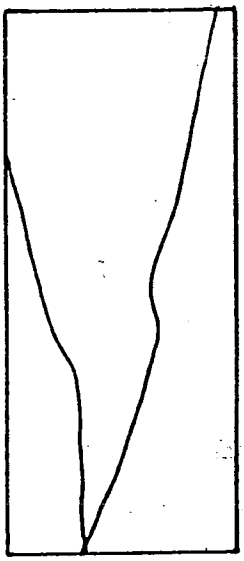
MG·B2·99
(49.0'-50.0')



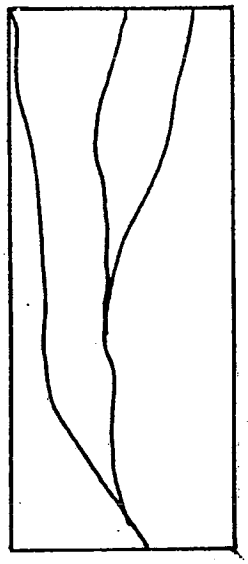
MG·B2·99
(81.0'-81.5')



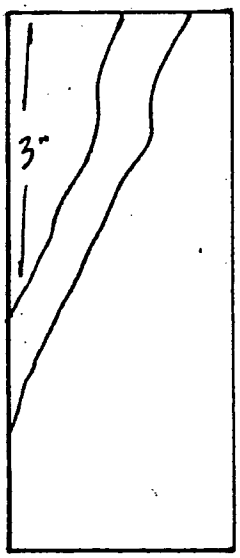
MG·B6·99
(38.0'-38.7')



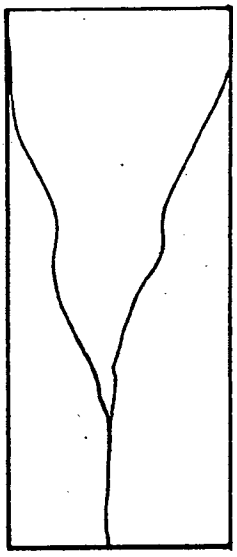
MG·B7·99
(82.8'-83.4')



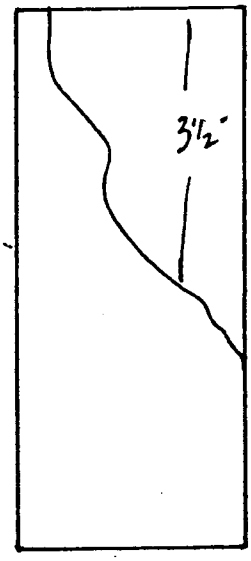
MG·B9·99
(71.5'-72.0')



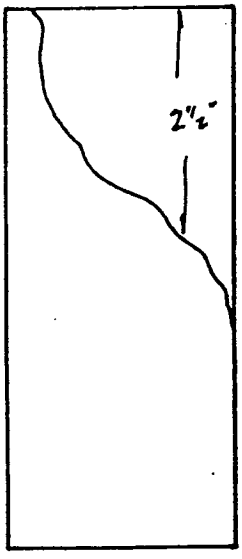
MG·B15·99
(70.5'-71.0')



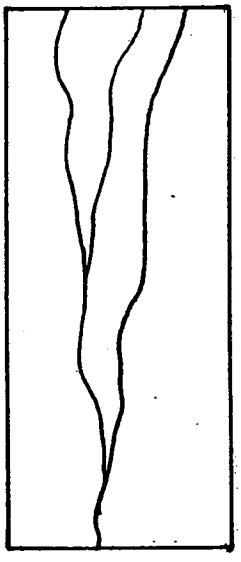
MG·B22·99
(73.0'-73.6')



MG·B24·99
(56.0'-57.0')



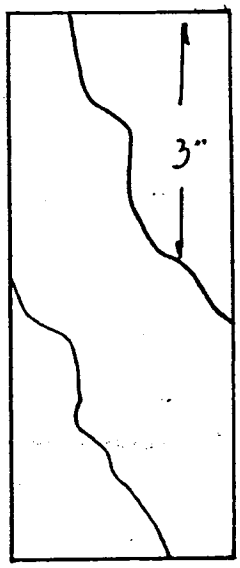
MG·B27·99
(69.3'-69.8')



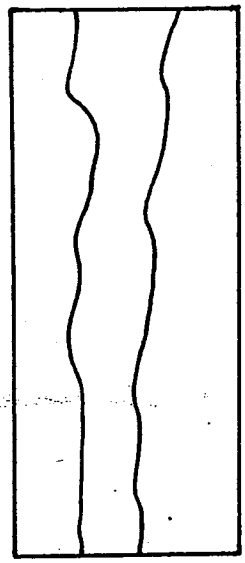
NOT TO SCALE

UNCONFINED COMPRESSION TESTS - FRACTURE LINES
(ROCK CORES)

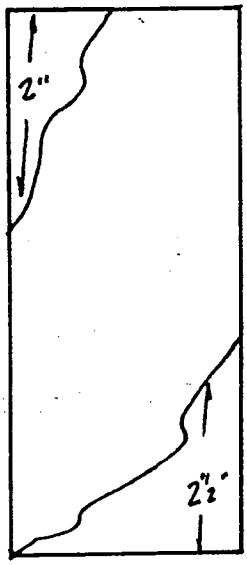
MG·B28·99
(61.8'-62.3')



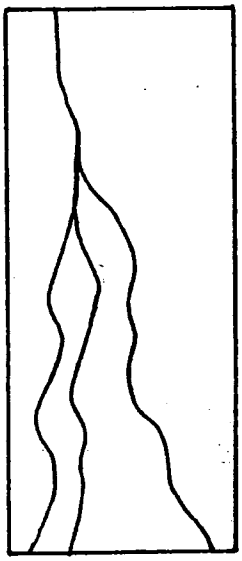
MG·B32·99
(29.0'-30.0')



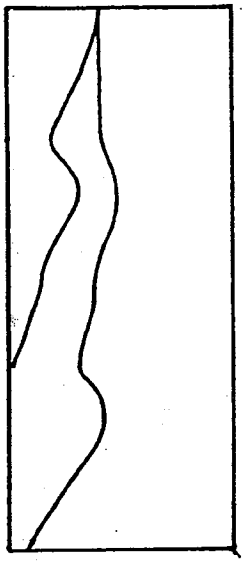
MG·B43·99
(46.1'-46.7')



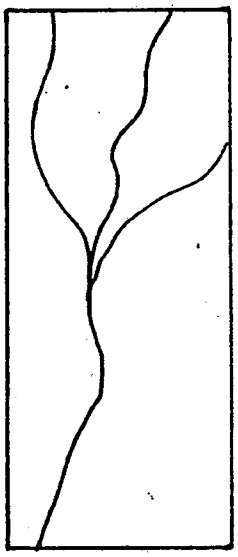
MG·B12·99
(79.5'-80.3')



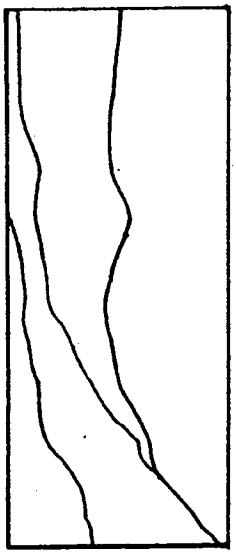
MG·B13·99
(66.9'-67.5')



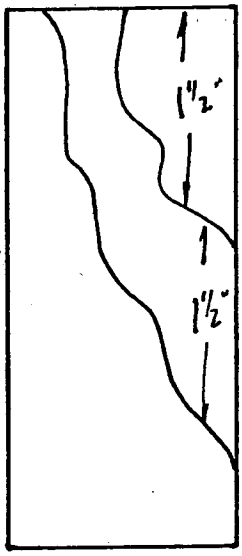
MG·B23·99
(66.5'-67.5')



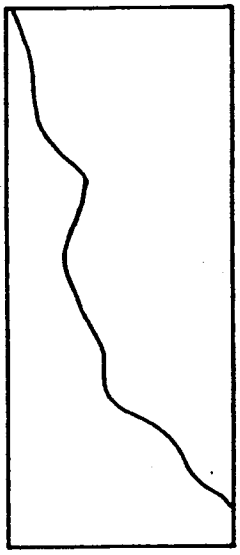
MG·30·99
(63.0'-63.7')



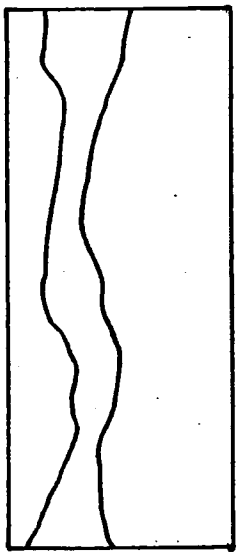
MG·B35·99
(55.4'-56.1')



MG·B35·99
(55.3'-56.0')



MG·B46·99
(48.0'-48.8')



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713

LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

Report No.: 2
Date: April 5, 1999

Client: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.
Project: CROTON WATER TREATMENT PLANT - HED 543
(MOSHOLU GOLD COURSE @ VAN CORTLANDT PARK - Bronx, NY)
Subject: PHYSICAL TESTING OF BORING SAMPLES - ROCK & SOIL

Samples Rec'd.: March 18, 1999
Test Revision Rec'd.: March 23, 1999

Del. By: LIMTL, Inc.

DIRECT TENSILE STRENGTH OF INTACT ROCK CORES (ASTM D-2936)

Rock samples were catalogued, processed, prepared, and tested in accordance with ASTM D-2936 and referenced documents.

Sample Identification	MG-B1-99	MG-B2-99	MG-B2-99	MG-B3-99	MG-B6-99
Depth	44.0'-44.7'	58.8'-56.5'	119.0'-120.0'	52.8'-53.5'	19.1'-19.6'
Moisture Condition	LABORATORY AIR DRIED				
Height of Specimen(in.)	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	1.99	1.87	1.87	1.87	1.99
Area (sq.in.)	3.11	2.76	2.76	2.76	3.11
Total Load (lbs.)	2,242	2,124	2,478	2,289	2,360
Rate of Loading (lbs./min.)	50	50	50	50	50
Tensile Strength (psi)	720	770	900	830	760

Sample Identification	MG-B7-99	MG-B7-99	MG-B15-99	MG-B15-99	MG-B16-99
Depth	35.0'-35.5'	58.0'-58.5'	24.5'-25.0'	44.0'-44.6'	31.8'-32.4'
Moisture Condition	LABORATORY AIR DRIED				
Height of Specimen(in.).	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	1.99	1.99	1.99	1.99	2.00
Area (sq.in.)	3.11	3.11	3.11	3.11	3.14
Total Load (lbs.)	2,620	2,997	2,430	2,549	1,935
Rate of Loading (lbs./min.)	50	50	50	50	50
Tensile Strength (psi)	840	960	780	820	620

Sample Identification	MG-B17-99	MG-B22-99	MG-B24-99	MG-B24-99	MG-B39-99
Depth	22.5'-23.25'	48.0'48.7'	22.0'-22.5'	46.0'-46.5'	24.5'-25.0'
Moisture Condition	LABORATORY AIR DRIED				
Height of Specimen(in.)	5.00	5.00	5.00	5.00	5.00
Diameter (in.)	2.00	1.99	2.00	2.00	1.99
Area (sq.in.)	3.14	3.11	3.14	3.14	3.11
Total Load (lbs.)	2,478	1,652	3,068	3,233	2,218
Rate of Loading (lbs./min.)	50	50	50	50	50
Tensile Strength (psi)	790	530	980	1,030	710

Metcalf & Eddy of N.Y., Inc./
Hazen & Sawyer - JV

Sample Identification	MG-B43-99	MG-B13-99	MG-B23-99	MG-B30-99	MG-B35-99
Depth	23.8'-24.6'	67.5'-68.0'	67.75-68.5'	63.7'-64.5'	56.1'-57.0'
Moisture Condition	LABORATORY AIR DRIED				
Height of Specimen(in.)	5.00	3.88	5.00	5.00	5.00
Diameter (in.).	1.98	1.99	1.99	1.99	1.99
Area (sq.in.)	3.08	3.11	3.11	3.11	3.11
Total Load (lbs.)	991	1,888	1,298	2,808	3,162
Rate of Loading (lbs./min.)	50	50	50	50	50
Tensile Strength (psi)	320	610	*420	900	1,020

Sample Identification	MG-B46-99
Depth	49.0'-50.0'
Moisture Condition	LABORATORY AIR DRIED
Height of Specimen(in.)	5.00
Diameter (in.)	1.99
Area (sq.in.)	3.11
Total Load (lbs.)	2,076
Rate of Loading (lbs./min.)	50
Tensile Strength (psi)	670

*Fracture followed partially weathered seam.
Yield sketches attached.

LABORATORY TECH.: M.A. Barnett (#536)

Respectfully submitted,

LONG ISLAND MATERIALS TESTING LAB., INC.

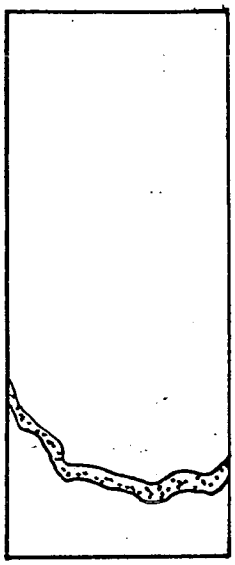
R.F. Barnett

R.F. Barnett
President

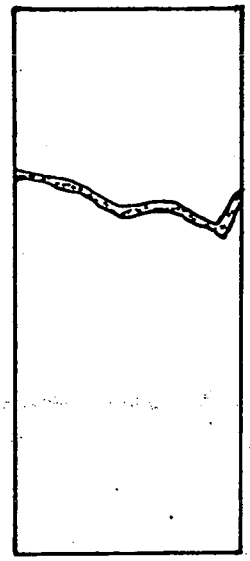
RFB:md/406
Copies: 3-client
2-acct'g.

DIRECT TENSILE STRENGTH TESTS - YIELD PRESENTATION SKETCH
(ROCK CORES)

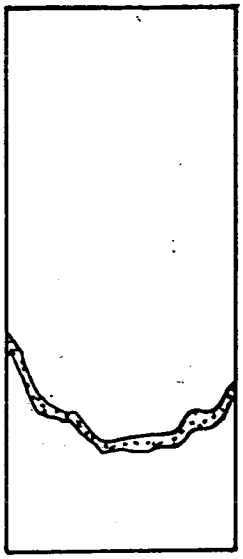
MG-B1-99
(44.0'-44.7')



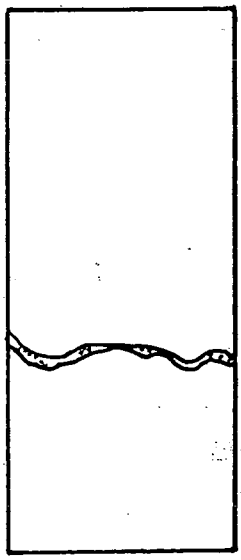
MG-B2-99
(55.8'-56.5')



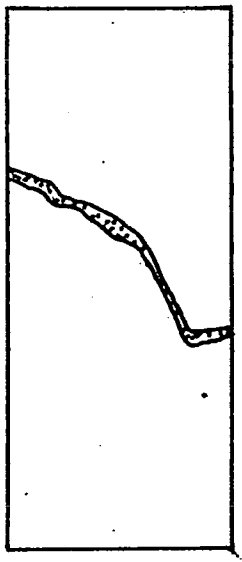
MG-B2-99
(119.0'-120.0')



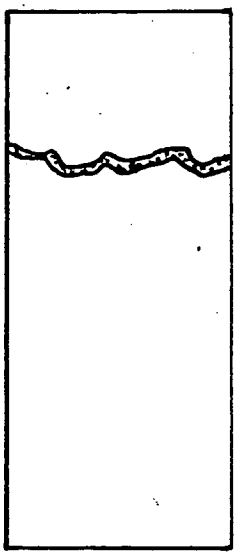
MG-B3-99
(52.8'-53.5')



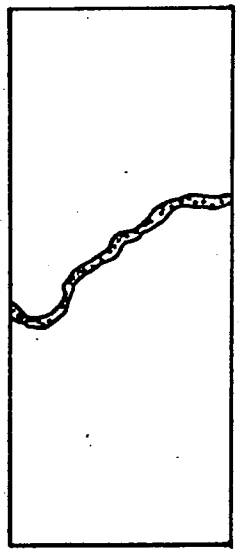
MG-B6-99
(19.1'-19.6')



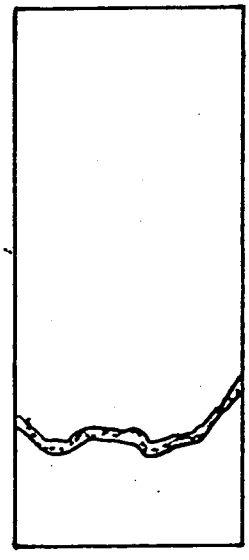
MG-B7-99
(35.0'-35.5')



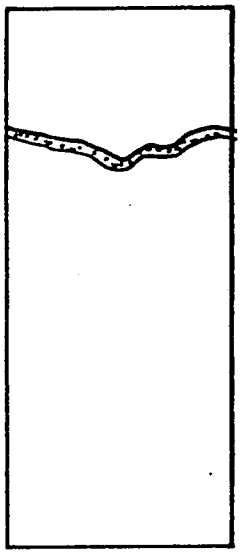
MG-B7-99
(58.0'-58.5')



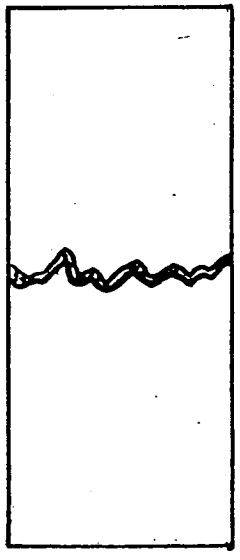
MG-B15-99
(24.5'-25.0')



MG-B15-99
(44.0'-44.6')



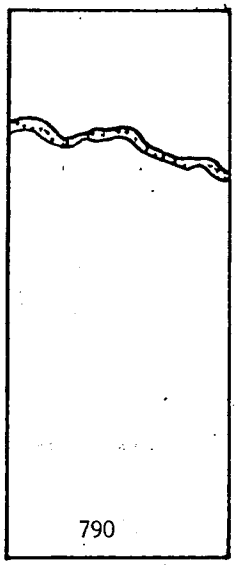
MG-B16-99
(31.8'-32.4')



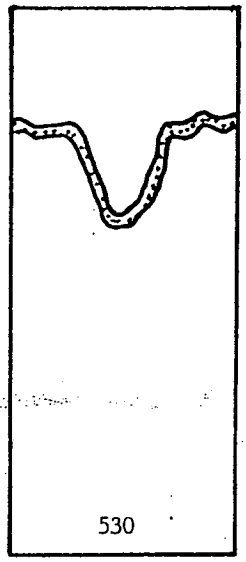
NOT TO SCALE

DIRECT TENSILE STRENGTH TESTS - YIELD PRESENTATION SKETCH
(ROCK CORES)

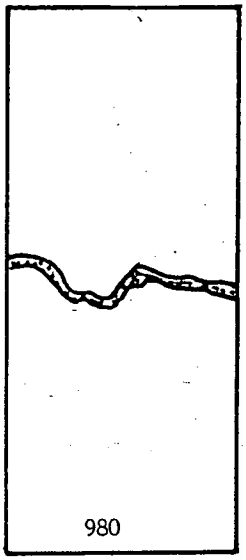
MG·B17·99
(22.5'-23.25')



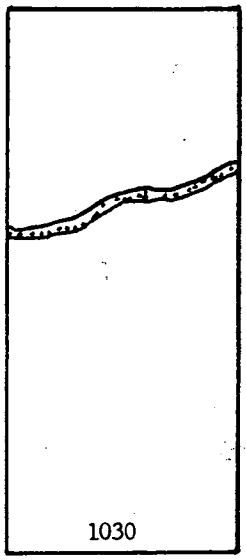
MG·B22·99
(48.0'-48.7')



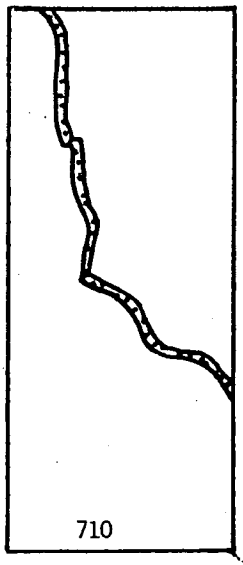
MG·B24·99
(22.0'-22.5')



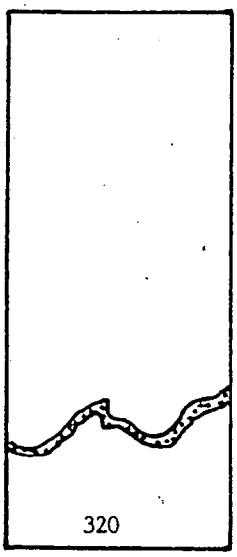
MG·B24·99
(46.0'-46.5')



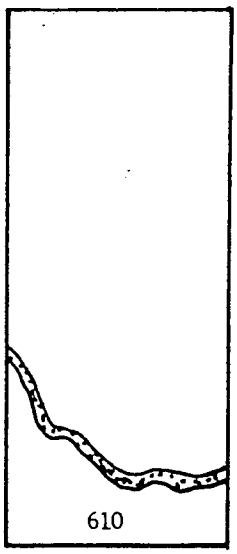
MG·B39·99
(24.5'-25.0')



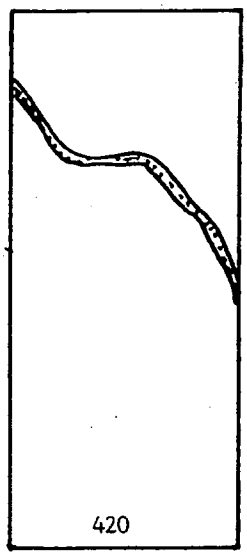
MG·B43·99
(23.8'-24.6')



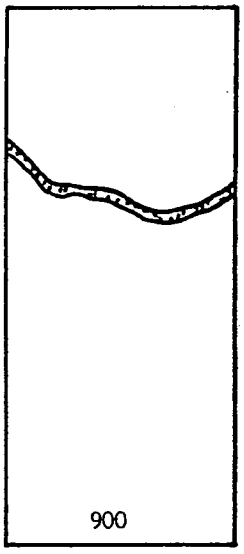
MG·B13·99
(67.5'-68.0')



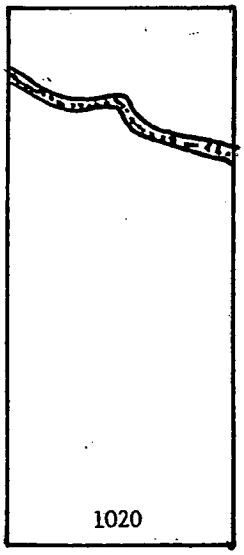
MG·B23·99
(67.75'-68.5')



MG·B30·99
(63.7'-64.5')



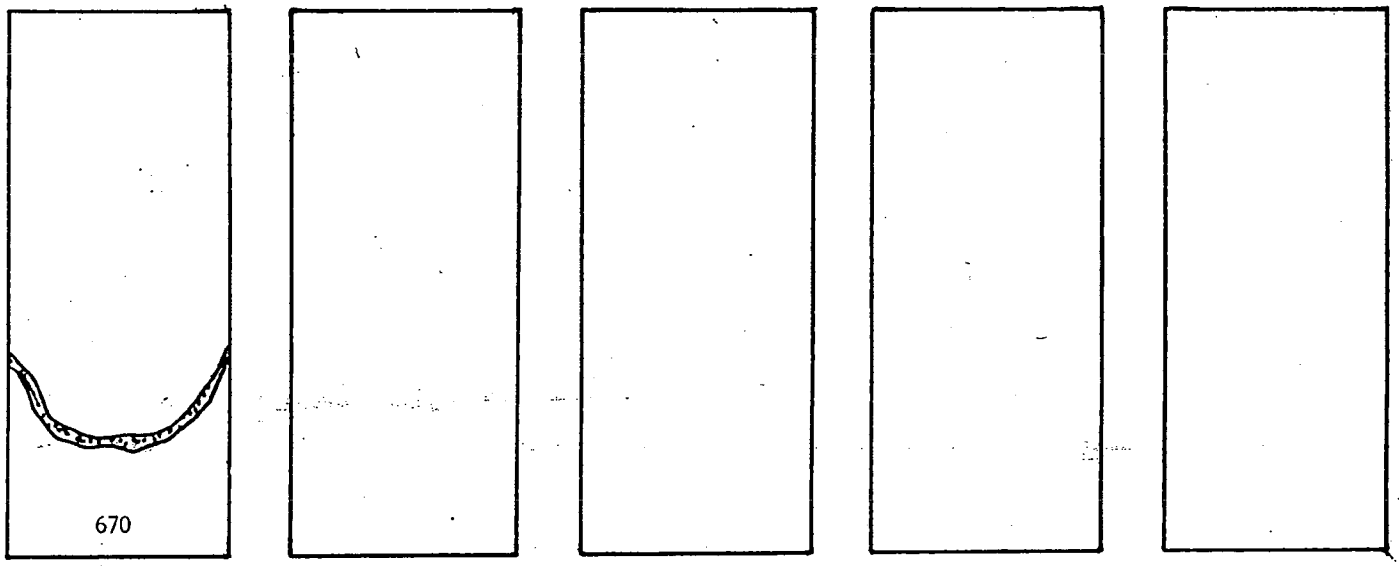
MG·B35·99
(56.1'-57.0')

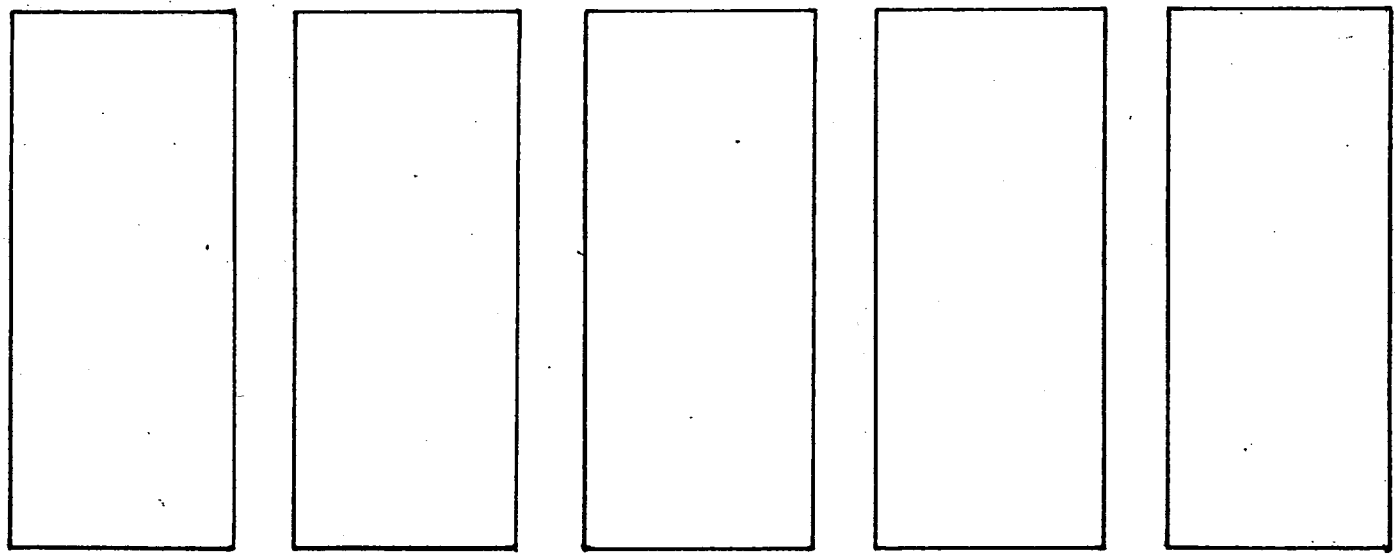


NOT TO SCALE

DIRECT TENSILE STRENGTH TESTS - YIELD PRESENTATION SKETCH
(ROCK CORES)

MG-B46-99
(49.0'-50.0')





NOT TO SCALE

long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713

LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

Date: April 9, 1999

Client: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.
Project: CROTON WATER TREATMENT PLANT - HED-543
(MOSHOLU GOLF COURSE @ VAN CORTLANDT PARK - Bronx, N.Y.)
Subject: PHYSICAL TESTING OF BORING SAMPLES - ROCK & SOIL

Samples Rec'd.: March 27, 1999 Del. By: LIMTL, Inc.

UNCONFINED COMPRESSION TESTING OF ROCK CORES (ASTM D-2938)

Rock samples were catalogued, processed, prepared, and tested in accordance with ASTM D-2938 and referenced documents.

Sample Identification	MG-B50-99	MG-B50-99	MG-B49-99	MG-B49-99	MG-B15-99
Depth	25.3'-26.0'	44.2'-44.7'	53.5'-54.0'	63.75'-54.25'	37.7'-38.4'
Temperature	ROOM TEMPERATURE 72°F ± 2°F				
Moisture Content	AS RECEIVED				
Height of Specimen(in.)	4.49	4.94		5.00	4.94
Diameter (in.)	2.00	2.00		2.00	1.98
Area (sq.in.)	3.14	3.14		3.14	3.08
Total Load (lbs.)	31,600	24,700	**	31,700	23,500
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	10,064	7,866		10,096	7,630

Sample Identification	MG-B41-99	MG-B21-99	MG-B21-99	MG-B21-99	MG-B18-99
Depth	15.7'-16.2'	24.8'-25.3'	62.0'-63.0'	35.0'-35.75'	32.0'-32.5'
Temperature	ROOM TEMPERATURE 72F ± 2°F				
Moisture Content	AS RECEIVED				
Height of Specimen(in.)	4.94	4.94	4.94	4.94	4.94
Diameter (in.)	1.98	2.00	2.00	2.00	1.98
Area (sq.in.)	3.08	3.14	3.14	3.14	3.08
Total Load (lbs.)	30,000	29,700	32,200	11,300	24,100
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	9,740	9,459	10,255	3,599	7,825

Sample Identification	MG-B18-99	MG-B10-99	MG-B10-99	MG-B16-99	MG-B3-99
Depth	52.1'-52.3'	26.0'-26.8'	53.5'-54.0'	64.5'-65.0'	34.7'-35.25'
Temperature	ROOM TEMPERATURE 72°F ± 2°F				
Moisture Content	AS RECEIVED				
Height of Specimen(in.)	4.94	4.94	4.56	4.94	5.00
Diameter (in.)	1.98	2.00	2.00	2.00	1.99
Area (sq.in.)	3.08	3.14	3.14	3.14	3.11
Total Load (lbs.)	11,900	43,100	17,500	28,600	16,200
Rate of Loading (lbs./min.)	4,000				
Compressive Strength (psi)	3,864	13,726	5,573	9,108	5,209

Sample Identification	MG-B1-99	MG-B42-99	MG-B42-99
Depth	49.5'-50.0'	49.0'-49.75'	27.5'-27.9'
Temperature	ROOM TEMPERATURE 72°F ± 2°F		
Moisture Content	AS RECEIVED		
Height of Specimen(in.)	4.81	4.94	4.88
Diameter (in.)	1.99	1.87	1.87
Area (sq.in.)	3.11	2.75	2.75
Total Load (lbs.)	8,100	9,800	12,700
Rate of Loading (lbs./min.)	4,000		
Compressive Strength (psi)	2,605	3,564	4,618

1) Fracture sketches attached. All cores fractured along or parallel to formation lines except B1 and B3, both of which evidenced "brooming" fractures.
2) **Sample not received.

LABORATORY TECH.: M.A. Barnett (#536)

Respectfully submitted,

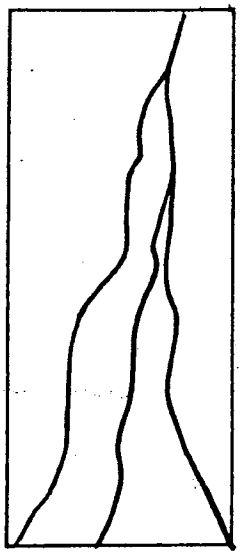
LONG ISLAND MATERIALS TESTING LAB., INC.

R.F. Barnett
President

RFB:md/409
Copies: 3-client
2-acct'g.

UNCONFINED COMPRESSION TESTS - FRACTURE LINES
(ROCK CORES)

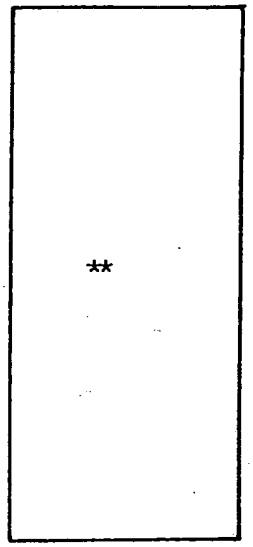
MG·B50·99
25.3'-26.0'



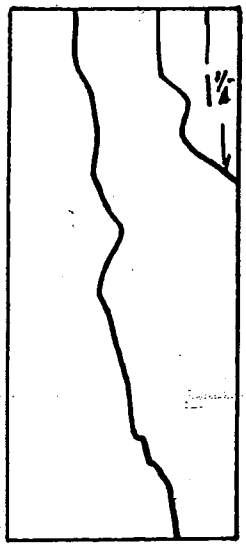
MG·B50·99
(44.2'-44.7')



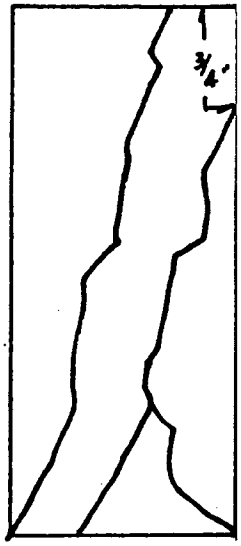
MG·B49·99
(53.5'-54.0')



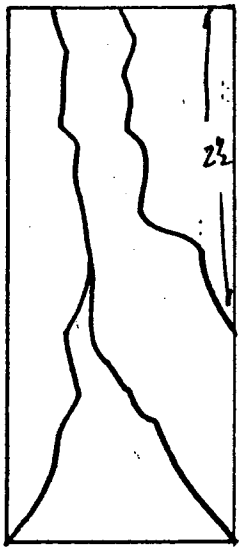
MG·B49·99
(63.75'-64.25')



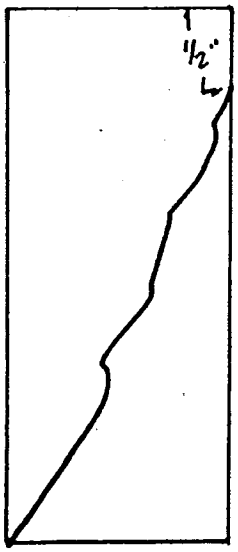
MG·B15·99
(37.7'-38.4')



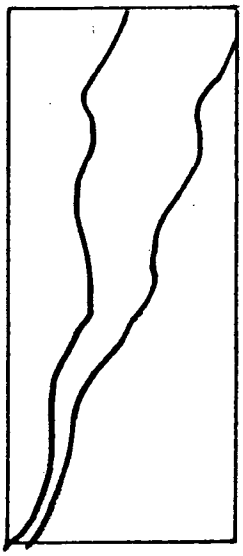
MG·B41·99
(15.7'-16.2')



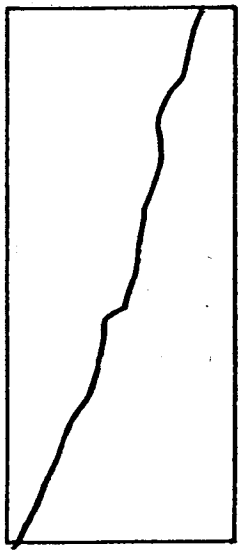
MG·B21·99
(24.8'25.3')



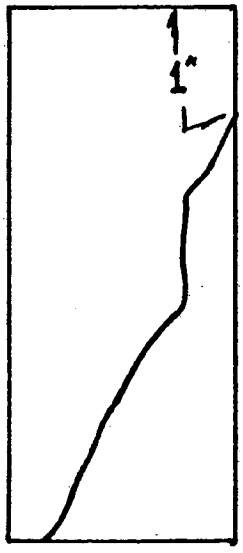
MG·B21·99
(62.0'-63.0')



MG·B21·99
(35.0'-35.75')



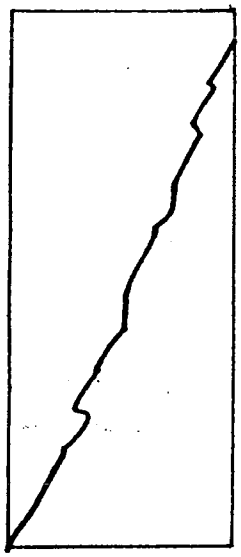
MG·B18·99
(32.0'-32.5')



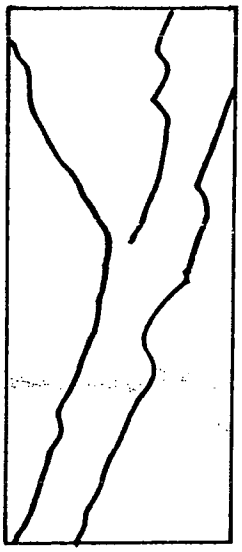
NOT TO SCALE

UNCONFINED COMPRESSION TESTS - FRACTURE LINES
(ROCK CORES)

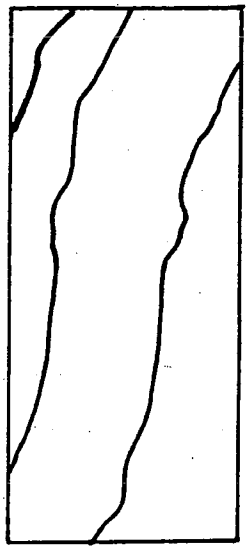
MG-B18-99
(52.1'-52.8')



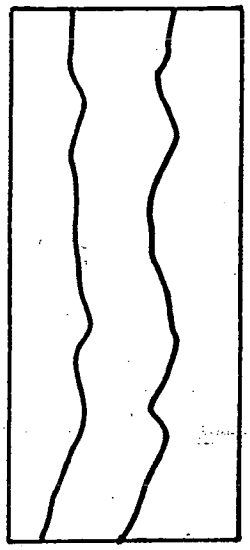
MG-B10-99
(26.0'-26.8')



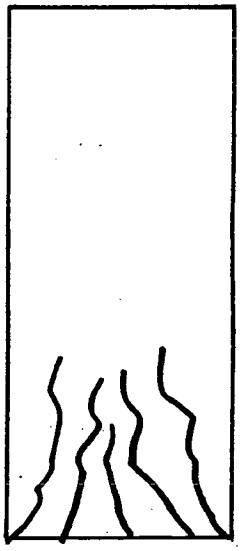
MG-B10-99
(53.5'-54.0')



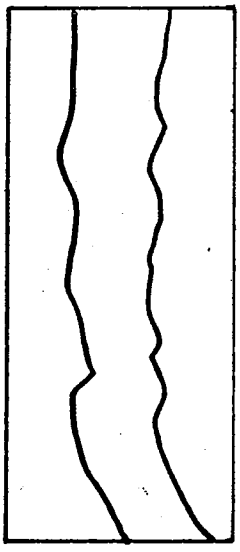
MG-B16-99
(64.5'-65.0')



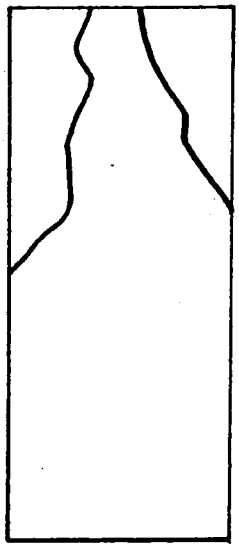
MG-B3-99
(34.7'-35.25')



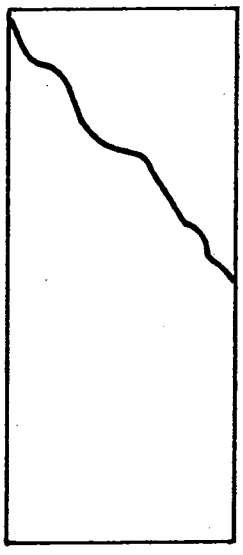
MG-B1-99
(49.5'-50.0')

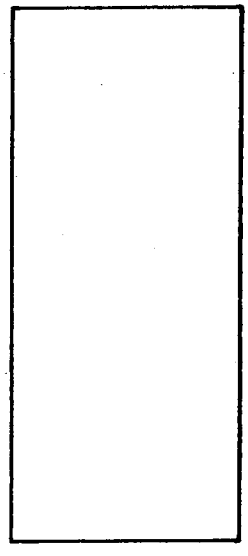


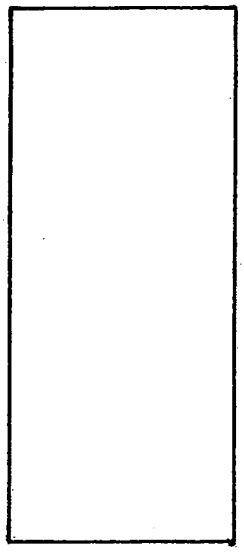
MG-B42-99
(49.0'-49.75')



MG-B42-99
(27:5'-27.9')







NOT TO SCALE

long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713

LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

Date: April 29, 1999

Client: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.

Project: CROTON WATER TREATMENT PLANT - HED-543
(MOSHOLU GOLF COURSE @ VAN CORTLANDT PARK - Bronx, N.Y.)

Subject: PHYSICAL TESTING OF BORING SAMPLES - ROCK & SOIL

Samples Rec'd.: March 27, 1999 Del. By: LIMTL, Inc.

ELASTIC MODULI OF INTACT ROCK CORES - UNIAXIAL COMPRESSION (ASTM D-3148)

Sample Identification	MG-B5-99	MG-B26-99	MG-B29-99	MG-B45-99	
Depth	50.75'-51.5'	57.75-58.6'	52.1-52.75'	39.75'-40.25'	
Moisture Condition	AS RECEIVED				
Height of Specimen (in.)	4.80	4.80	4.80	4.80	
Diameter (in.)	1.98	1.99	1.87	1.87	
Area (sq.in.)	3.08	3.11	2.75	2.75	
Rate of Loading (lbs./min.)	3000				
Total Load (lbs.)	22,800	18,200	17,800	20,800	
Compressive Strength (psi)	7,400	5,850	6,470	7,560	

PROCEDURE A				
Young's Modulus, E (ksi)	306	418	600	379
Stress Range (psi)	3400-6000	2400-4825	2900-5900	1950-4375
PROCEDURE B				
Poisson's Ratio	0.28	0.26	0.24	0.31
Stress Range (psi)	4200-7100	1600-3200	2800-4300	3600-6150

Sample Identification	MG-B17-99	MG-B20-99	MG-B31-99	MG-B39-99	MG-B40-99
Depth	47.4'-48.2'	63.5'-64.3'	60.5'-61.4'	56.1'-56.6'	51.8'-52.3'
Moisture Condition	AS RECEIVED				
Height of Specimen (in.)	5.00	5.00	4.94	5.00	5.00
Diameter (in.)	2.00	1.99	1.87	1.98	1.99
Area (sq.in.)	3.14	3.11	2.75	3.08	3.11
Rate of Loading (lbs./min.)	3000				
Total Load (lbs.)	23,600	29,800	38,100	24,900	31,000
Compressive Strength (psi)	7,515	9,580	13,855	8,080	9,970

PROCEDURE A					
Young's Modulus, E (ksi)	414	300	880	418	471
Stress Range (psi)	2400-4800	4100-7400	7200-11,600	5200-7500	4000-8000
PROCEDURE B					
Poisson's Ratio	0.14	0.34	0.24	0.24	0.10
Stress Range (psi)	3200-5800	4650-6000	3600-6500	3900-6500	2400-5800

CLIENT: Metcalf & Eddy of N.Y., Inc./Hazen & Sawyer - J.V.
PROJECT: CROTON WATER TREATMENT PLANT - HED-543
(MOSHOLU GOLF COURSE @ VAN CORTLANDT PARK - Bronx, N.Y.)

Report No.: 6
Date: April 29, 1999

SUBJECT: PHYSICAL TESTING OF BORING SAMPLES - ROCK & SOIL

Sample Identification	MG-B8-99	MG-B19-99	
Depth	81.0'-82.0'	68.8'-69.4'	
Moisture Condition	AS RECEIVED		
Height of Specimen (in.)	4.94	4.22	
Diameter (in.)	1.99	1.99	
Area (sq.in.)	3.11	3.11	
Rate of Loading (lbs./min.)	3000		
Total Load (lbs.)	27,700	58,500	
Compressive Strength (psi)	8,910	18,810	

PROCEDURE A		
Young's Modulus, E (ksi)	897	479
Stress Range (psi)	3200-8000	7700-12,200
PROCEDURE B		
Poisson's Ratio	0.34	0.04
Stress Range (psi)	1600-4800	1,000-18,000

REMARKS: The slope of the axial and lateral curves were determined by taking the average slope of linear portion of the curves within the listed stress range. The compression-positive sign convention was employed in plotting curves.

LAB. TECHNICIAN: M.A. Barnett (#536)
R.F. Barnett (#448)

Respectfully submitted,

LONG ISLAND MATERIALS TESTING LAB., INC.

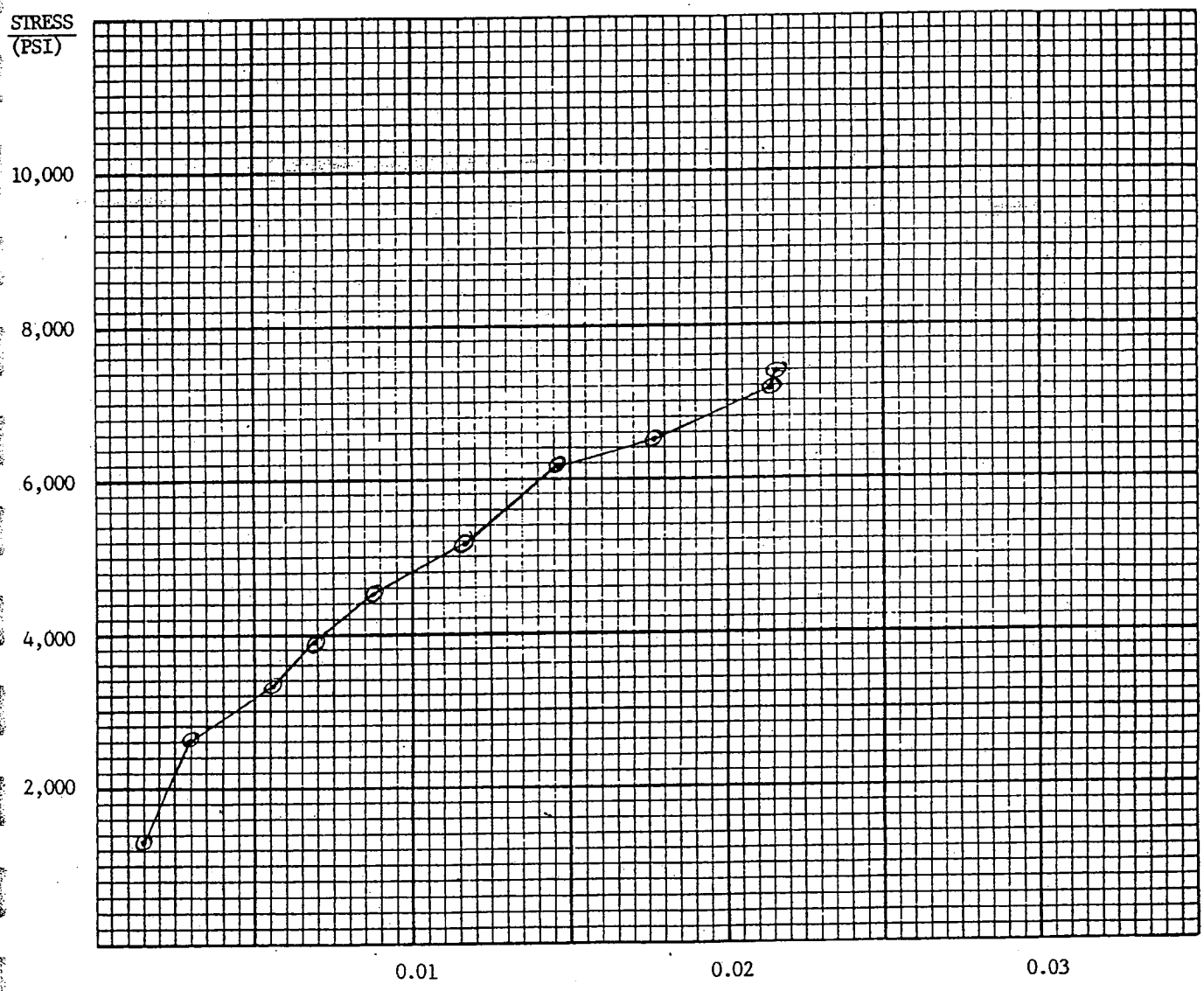
R.F. Barnett
President

RFB:md/429
Copies: 3-client
2-acct'g.

long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

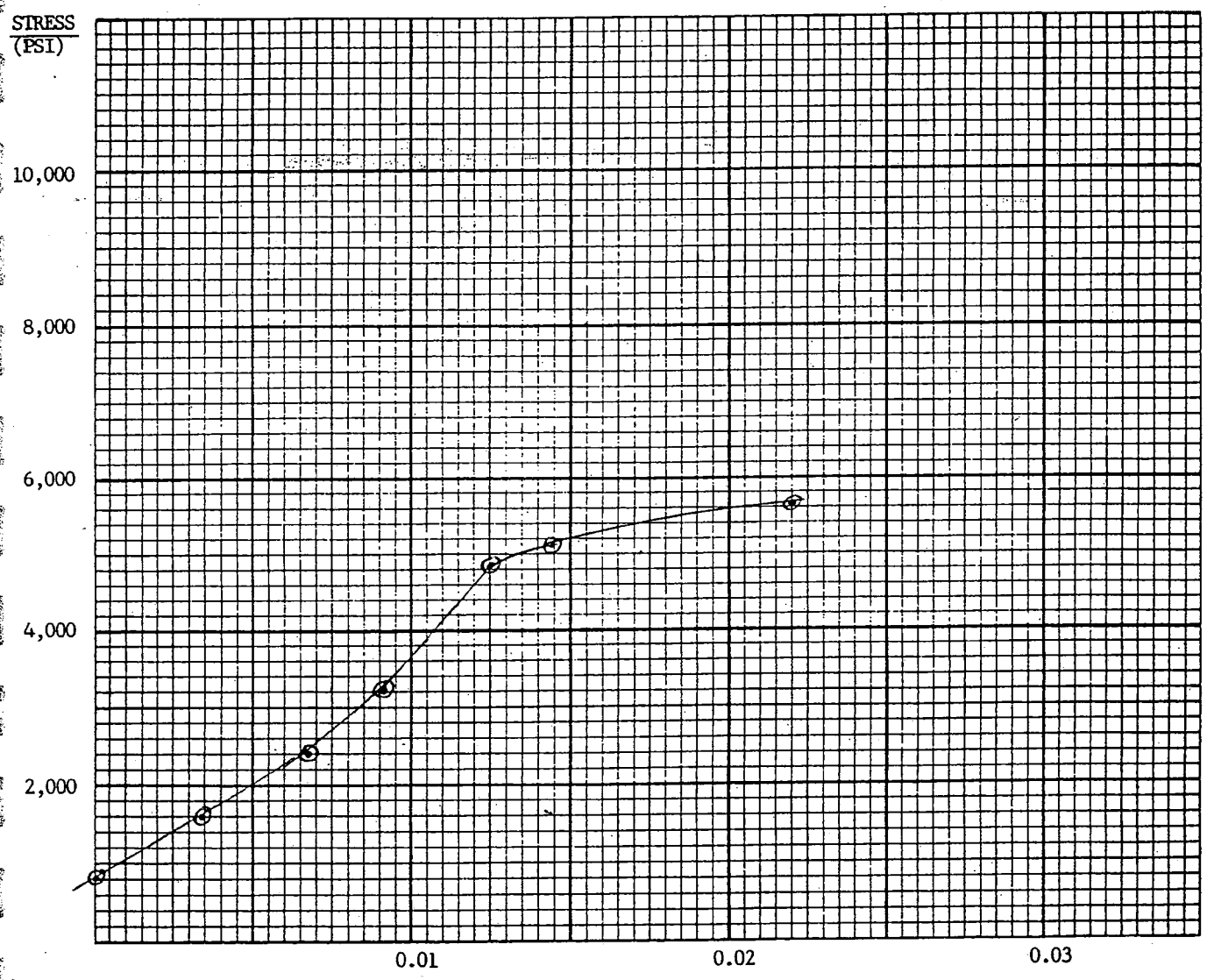
BORING NO.: B5



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

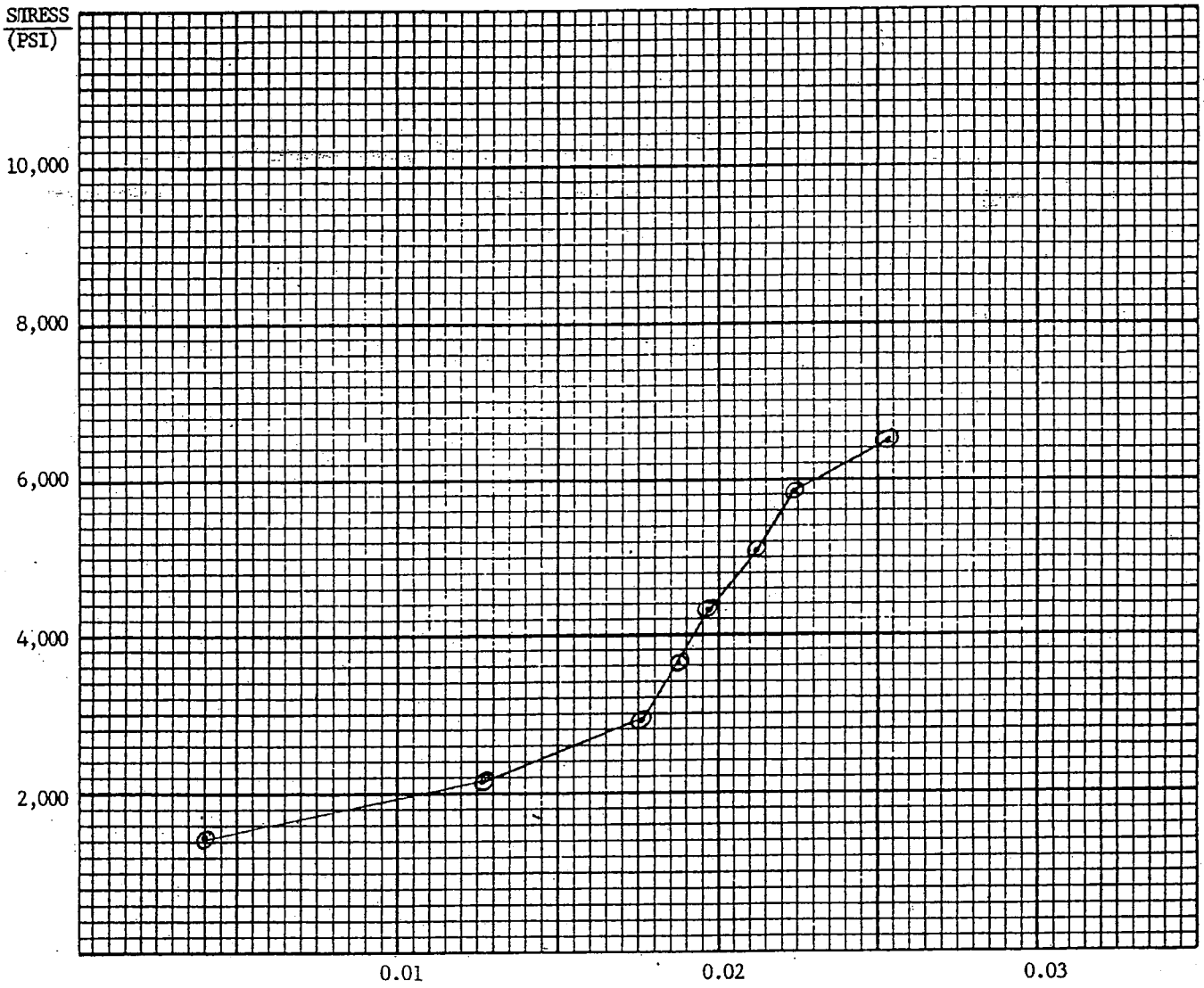
BORING NO.: B26



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 ☐

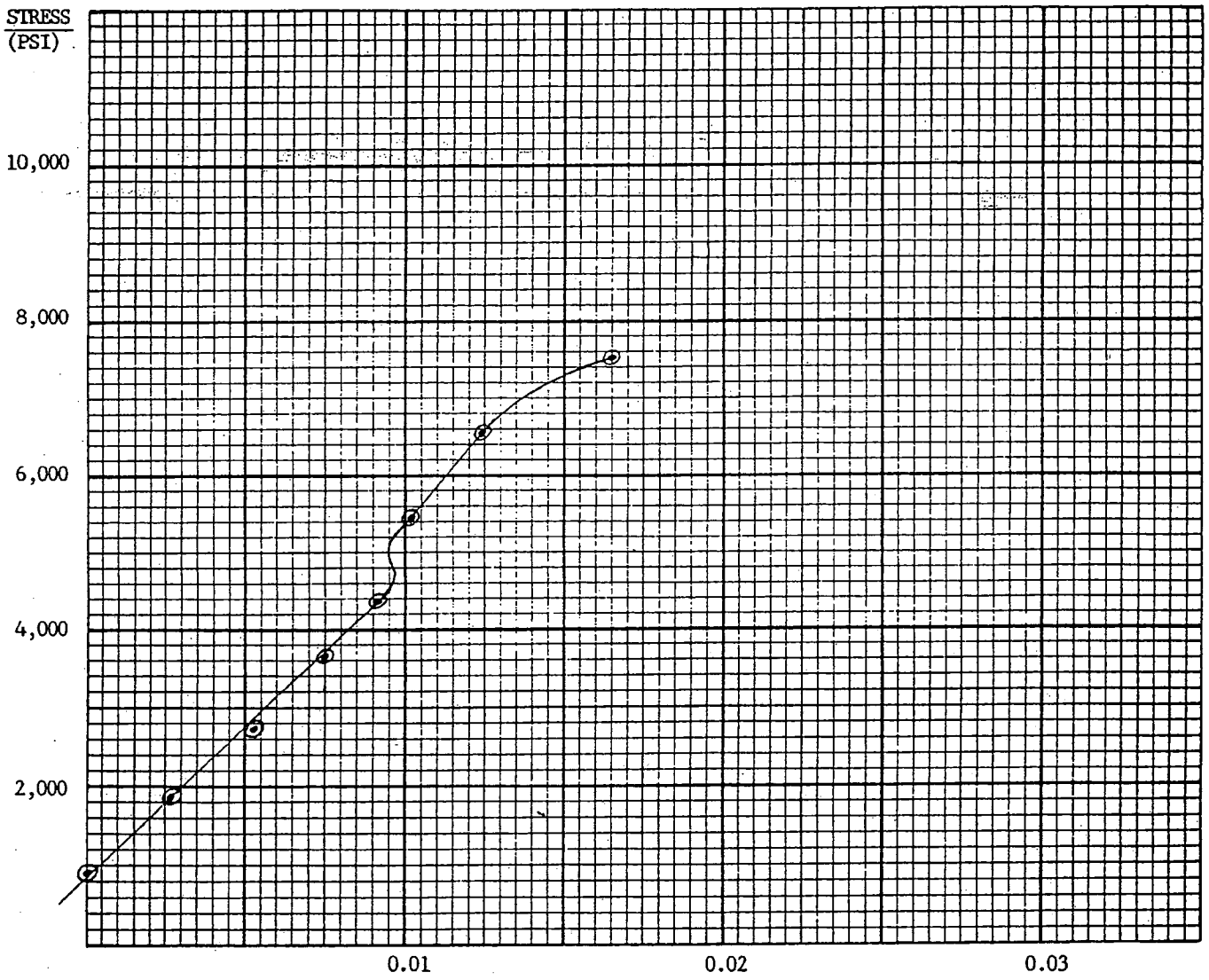
BORING NO.: B29



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

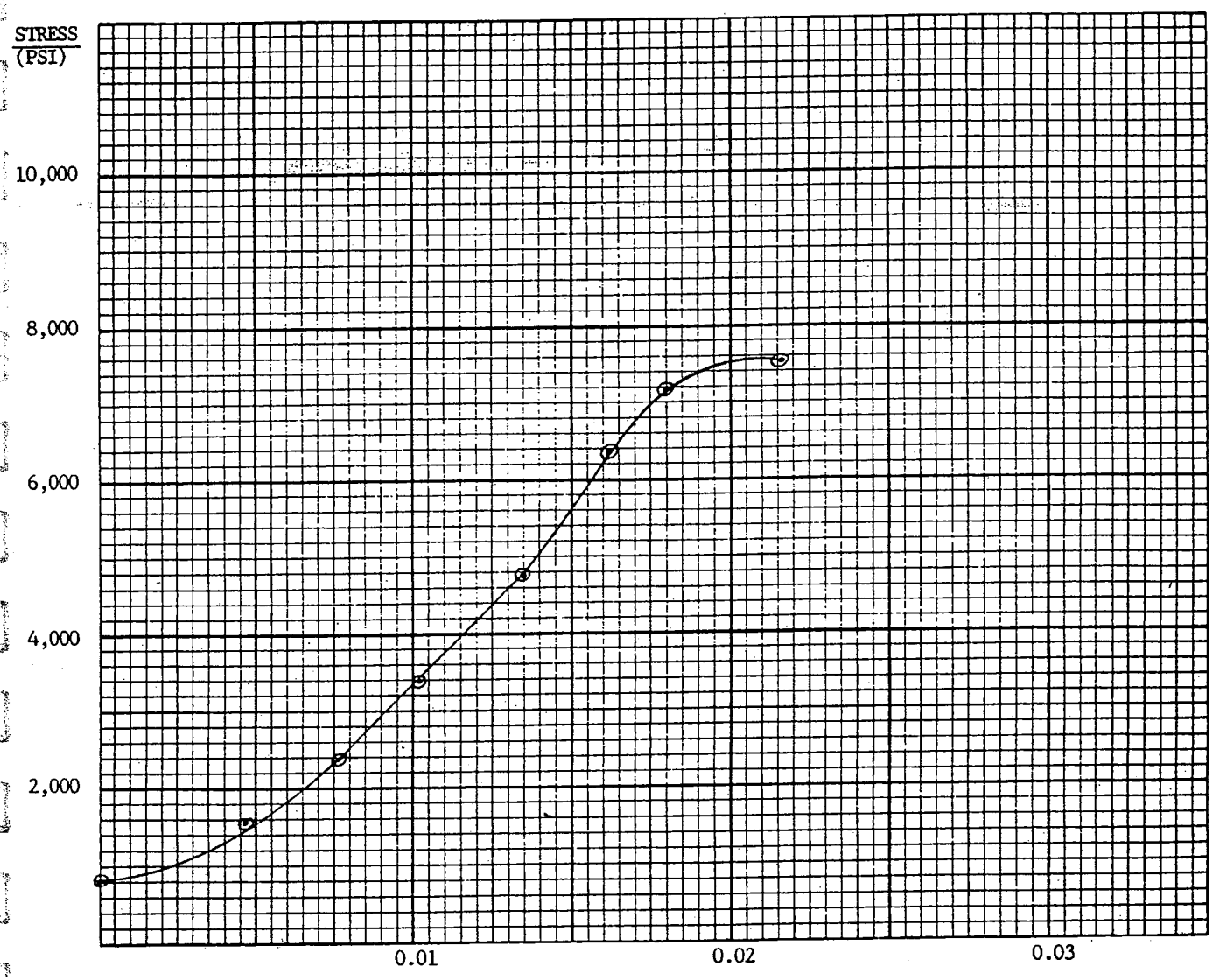
BORING NO.: B45



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

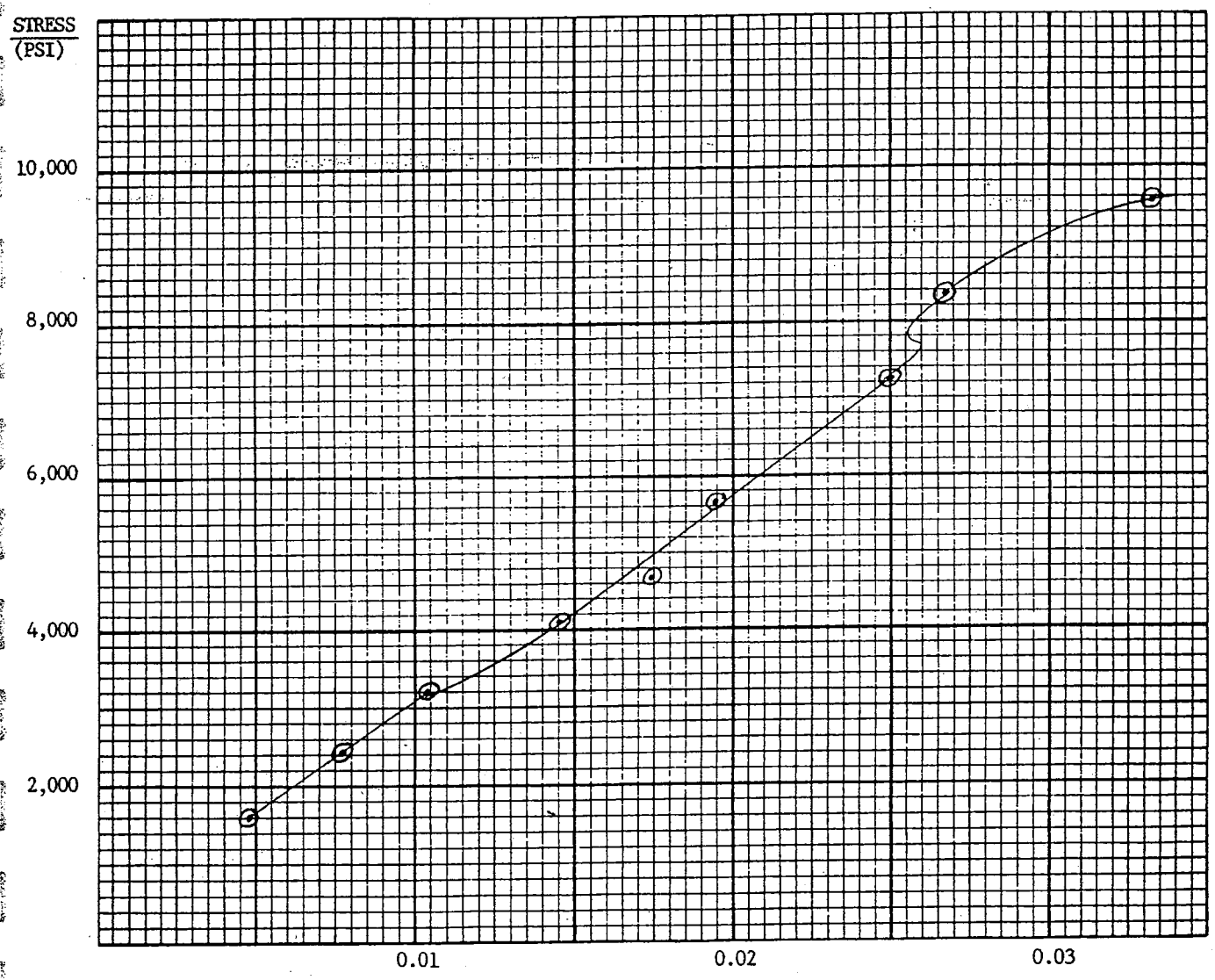
BORING NO.: B17



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

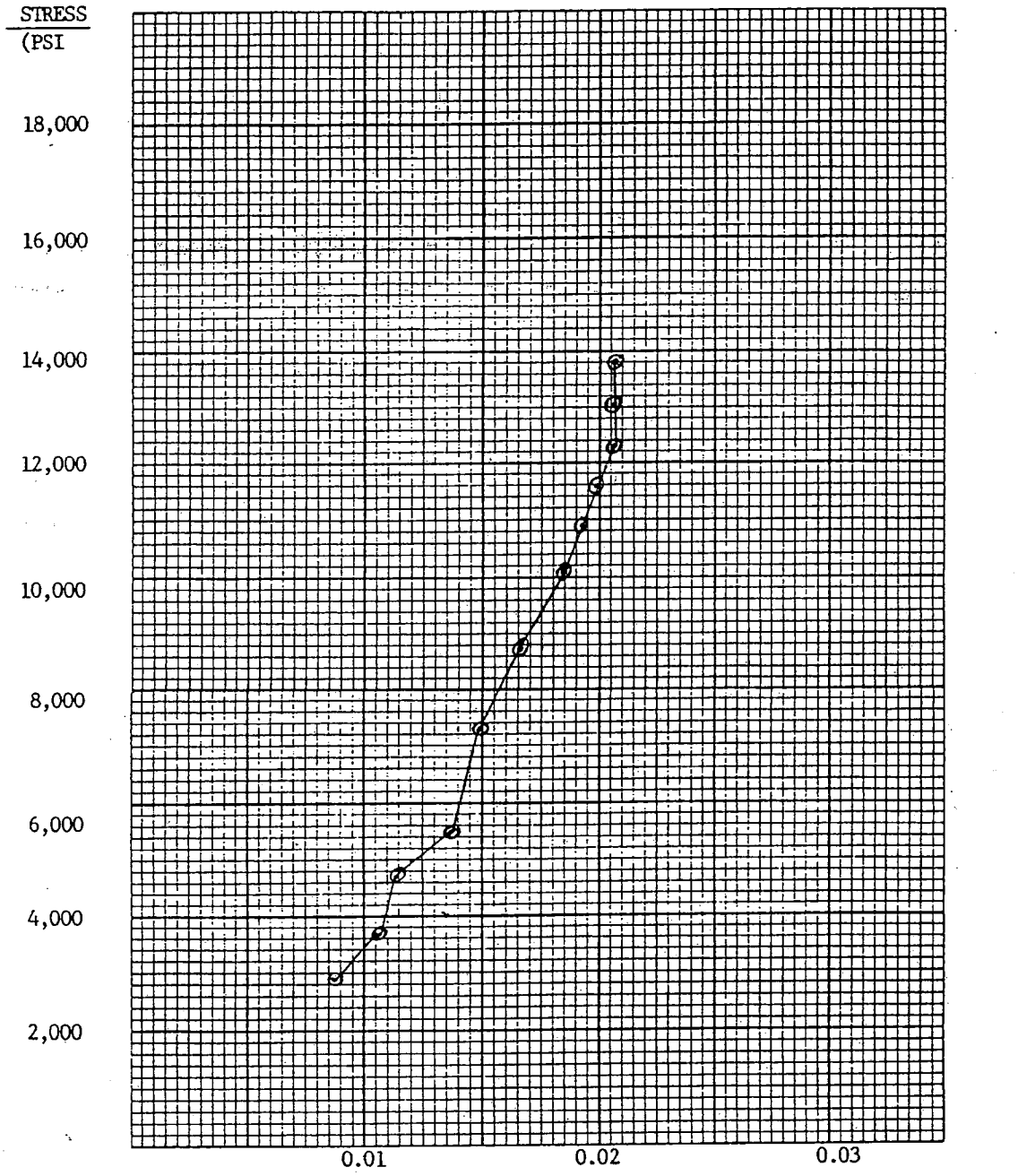
BORING NO.: B20



long island materials testing laboratories, inc.

N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-6300 — (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

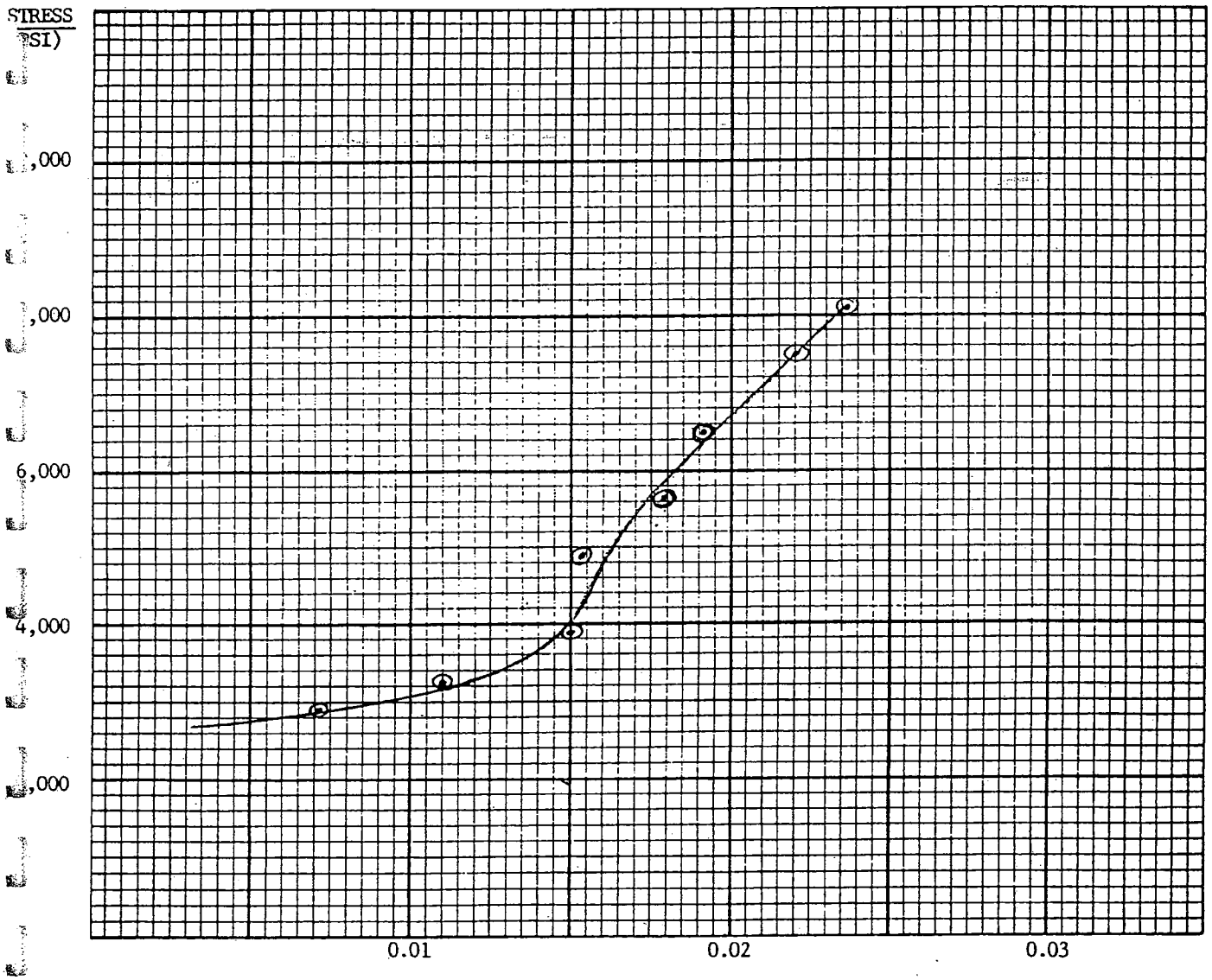
BORING NO.: B31



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 ☐

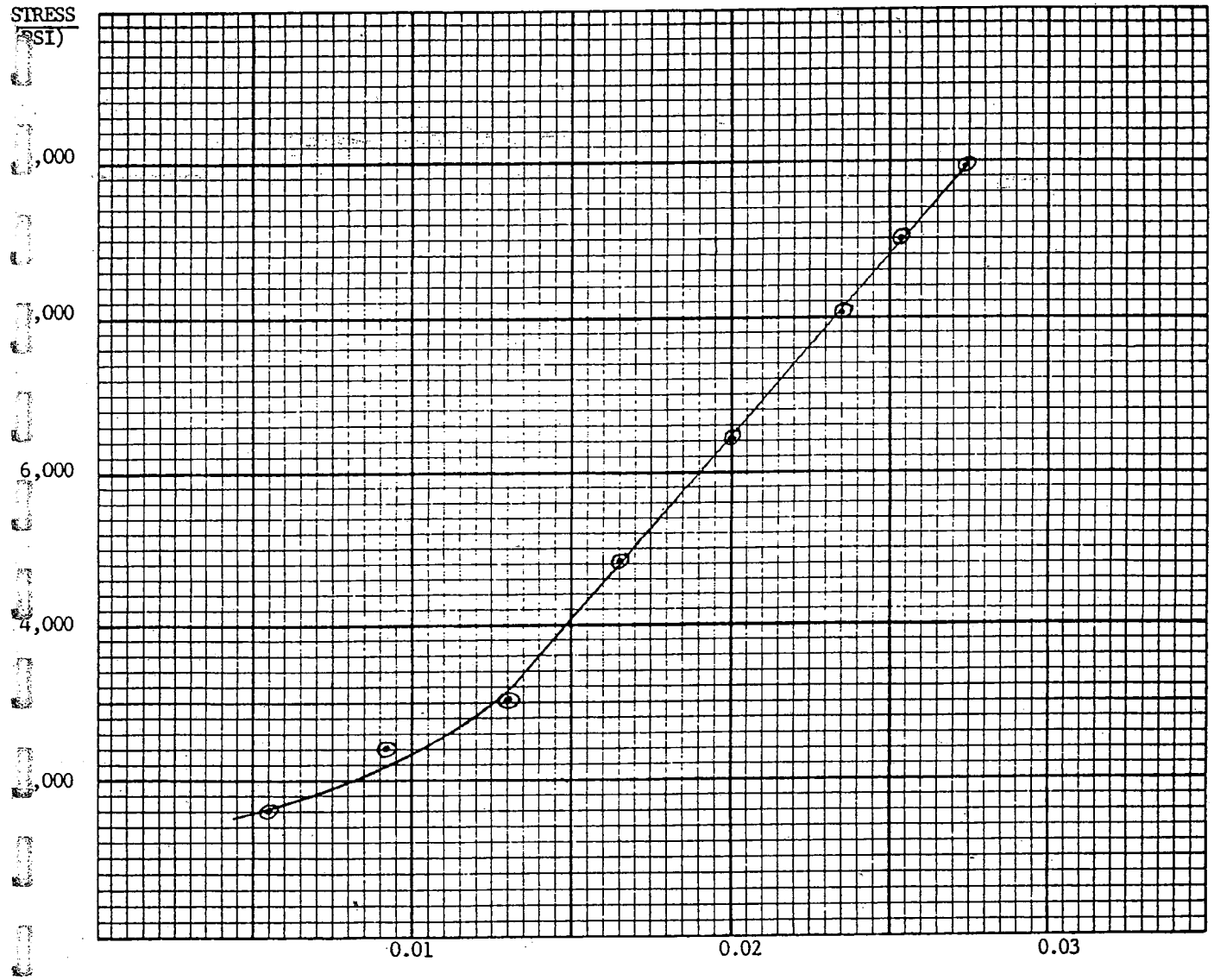
BORING NO.: B39



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

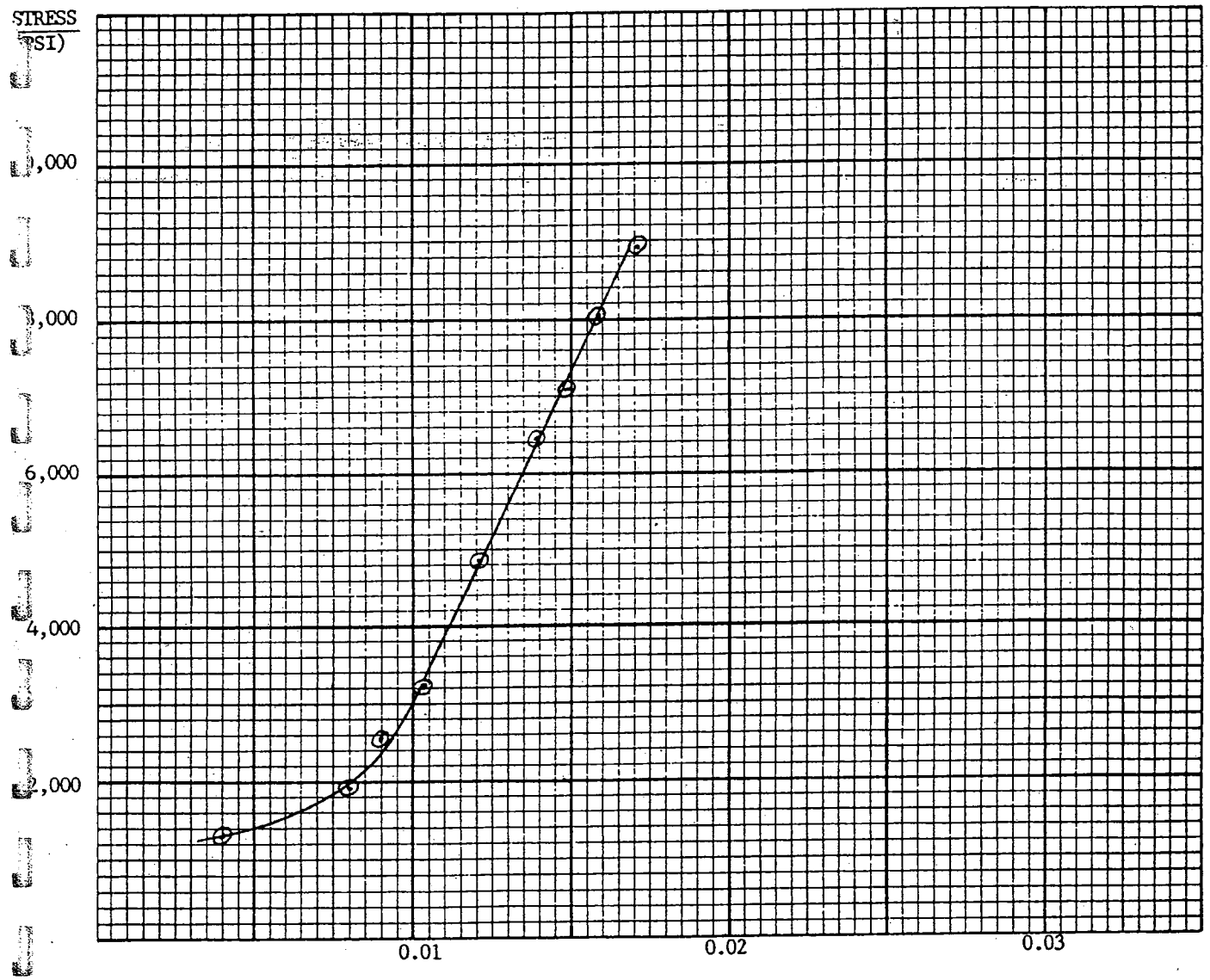
BORING NO.: B40



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 ☐

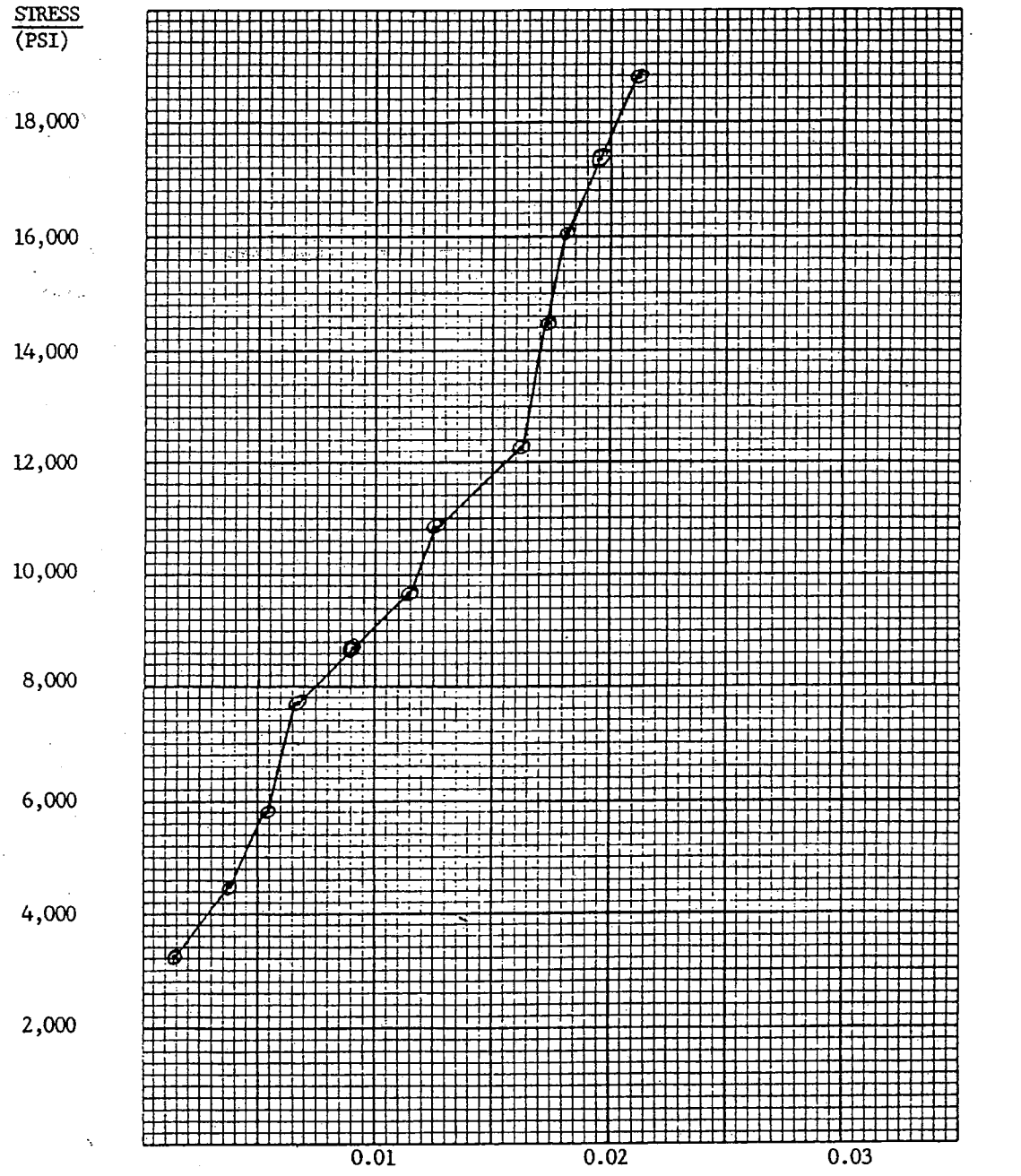
BORING NO.: B8



long island materials testing laboratories, inc.

N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-6000 • (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

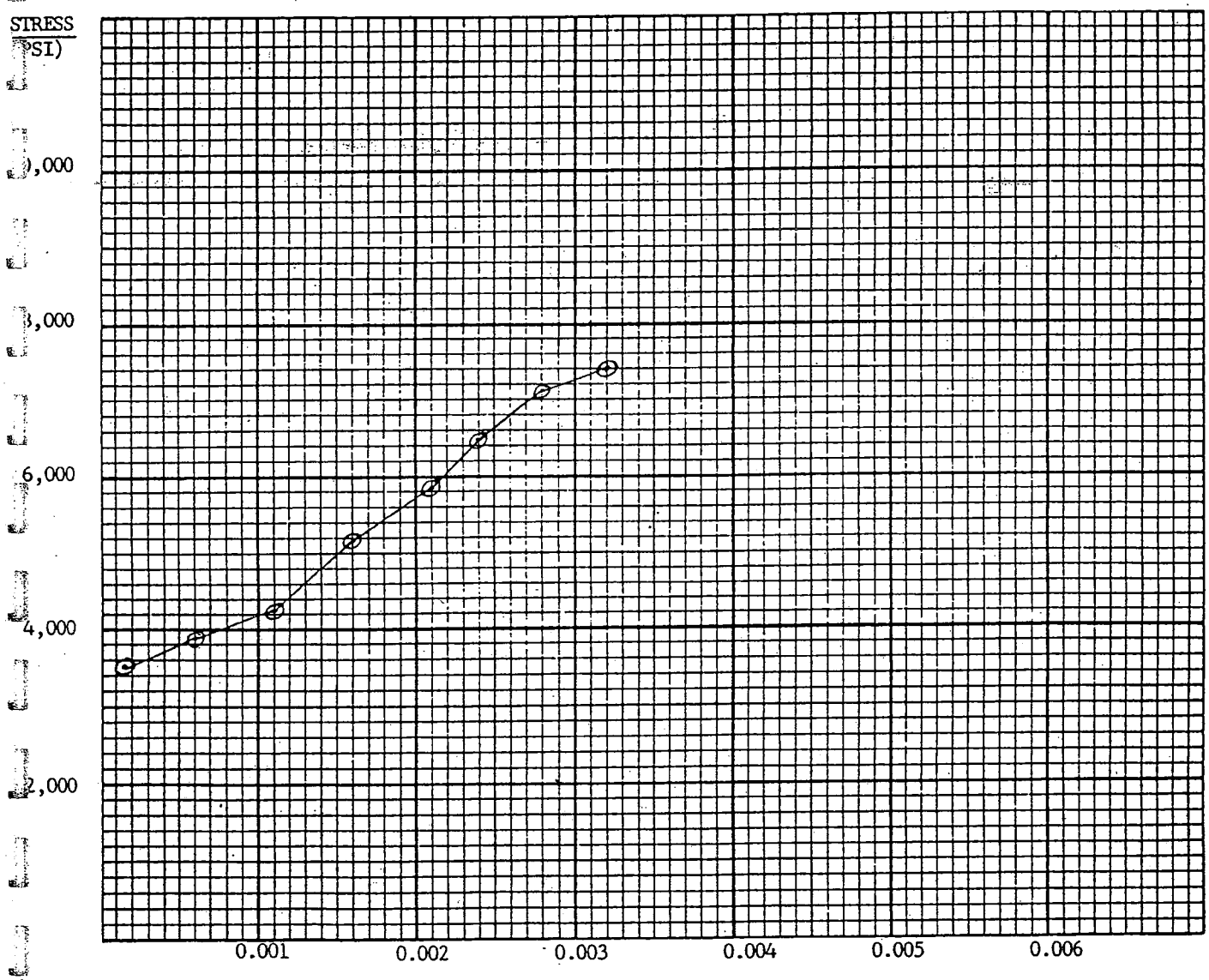
BORING NO.: B19



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

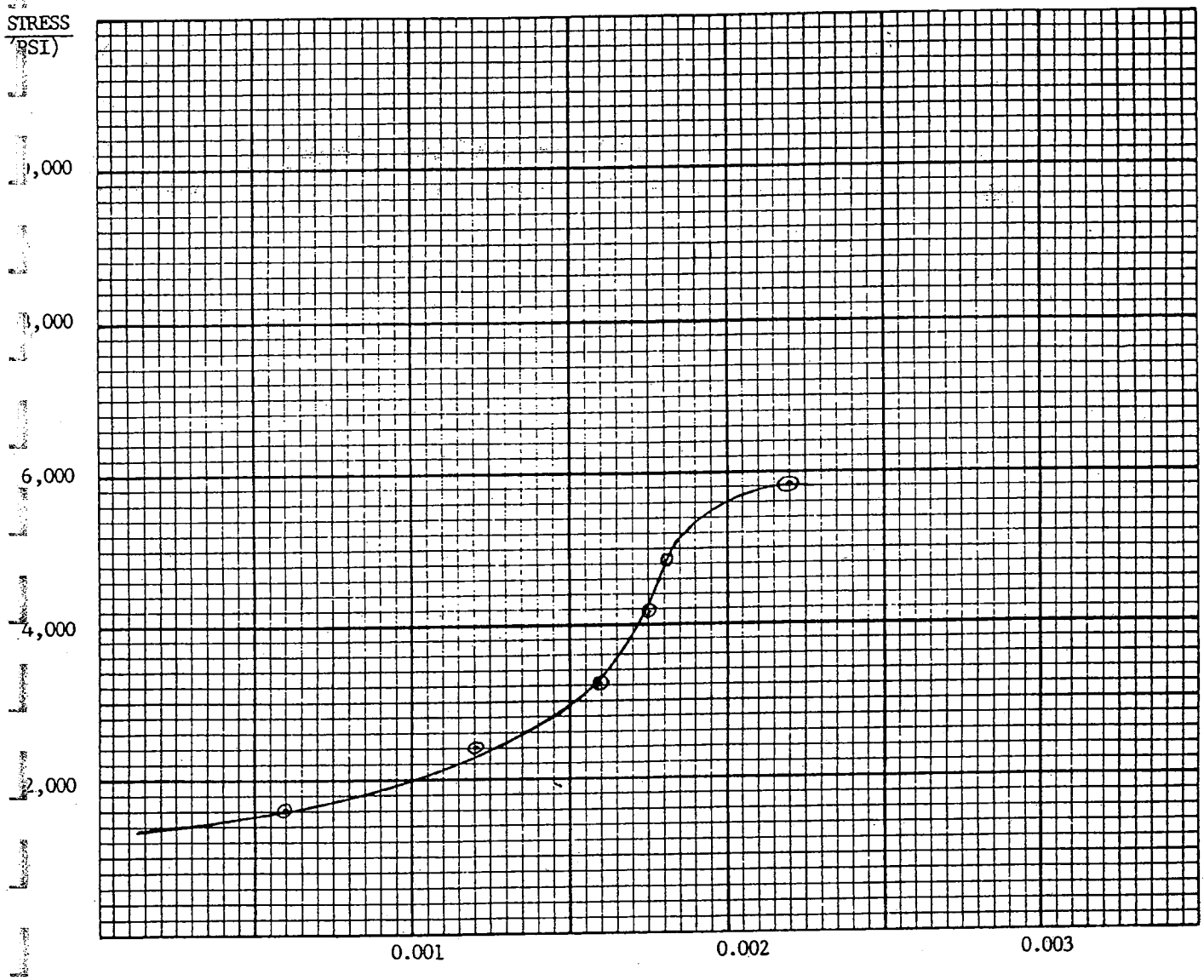
BORING NO: B5



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 ☐

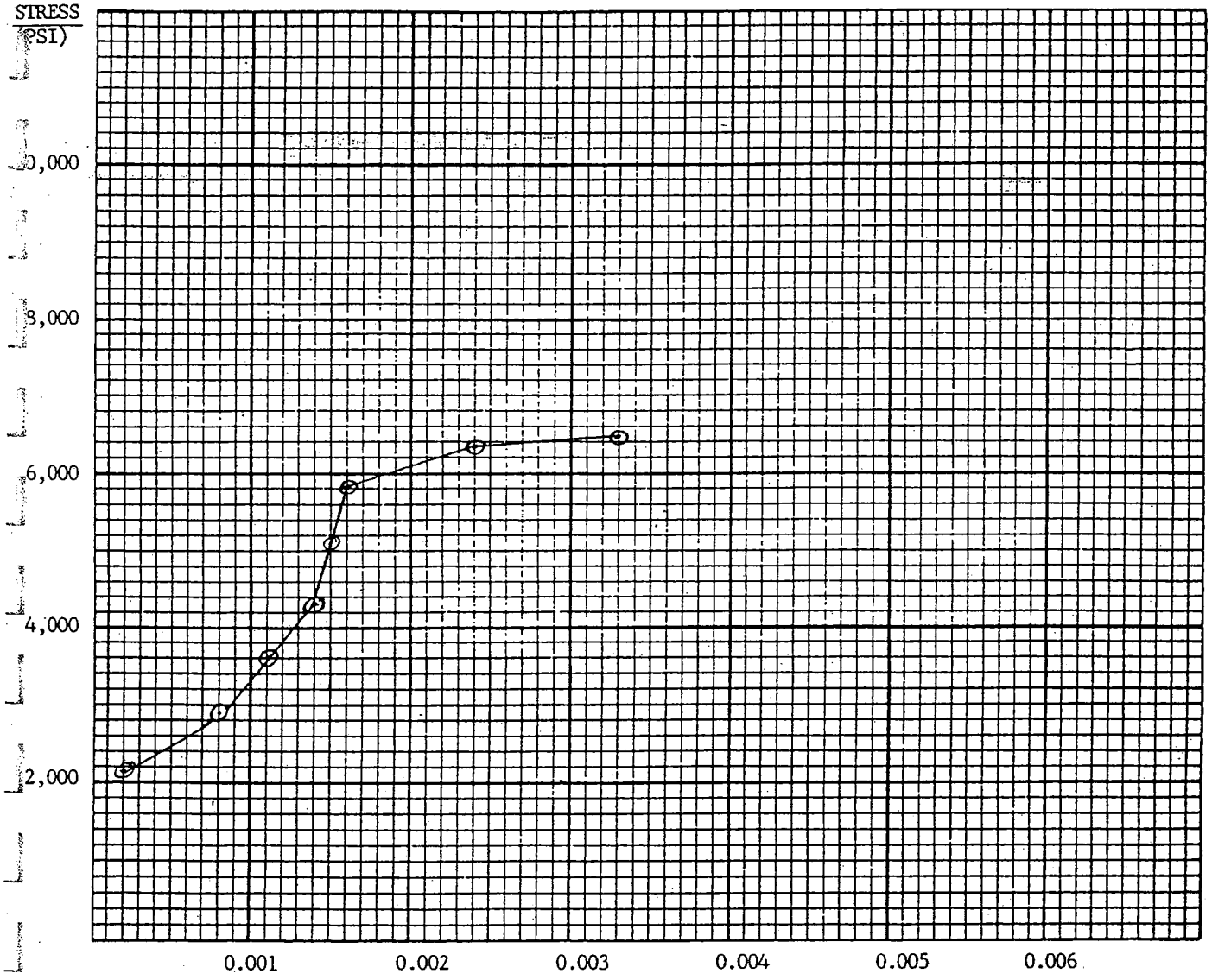
BORING NO.: B26



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

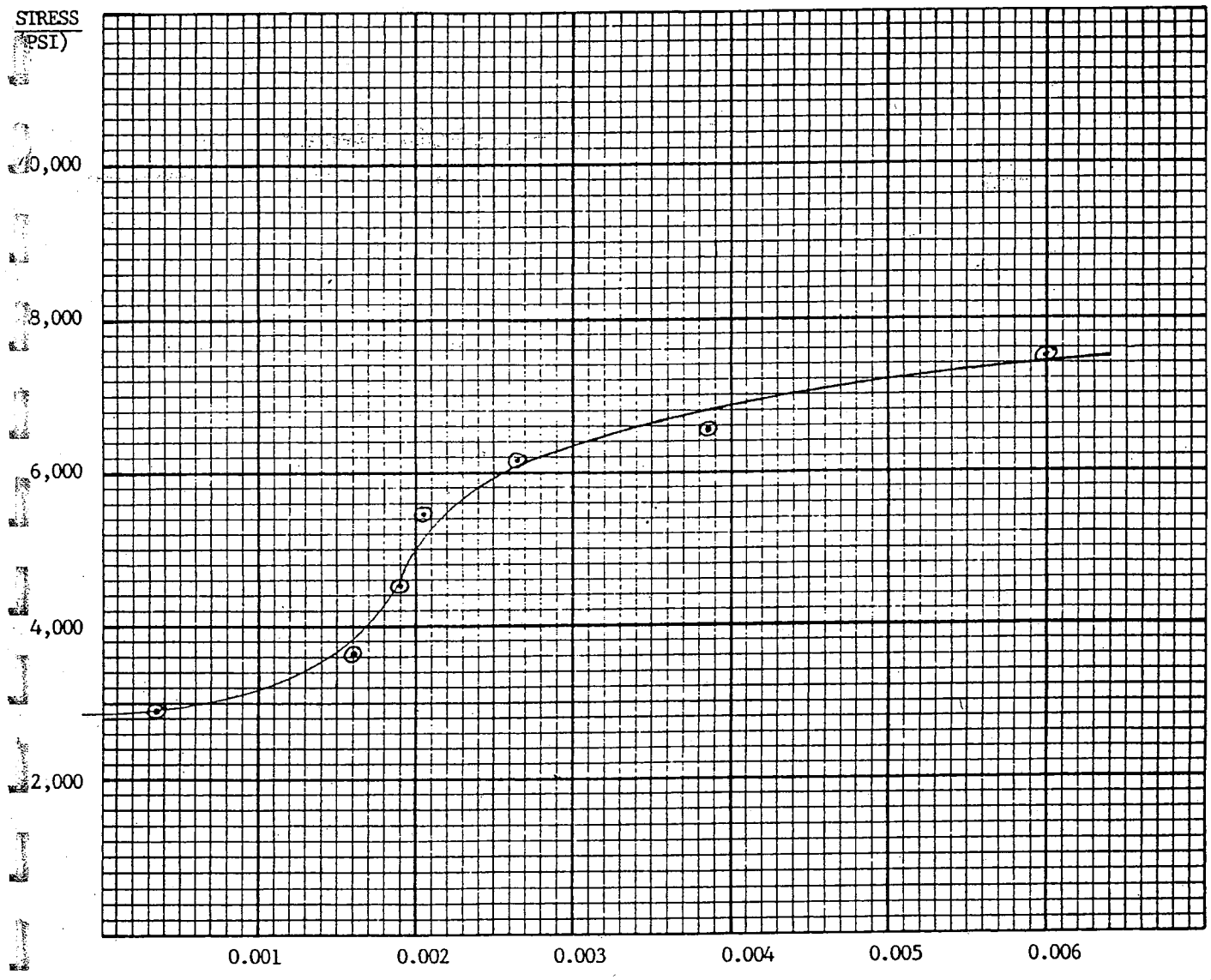
BORING NO.: B29



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

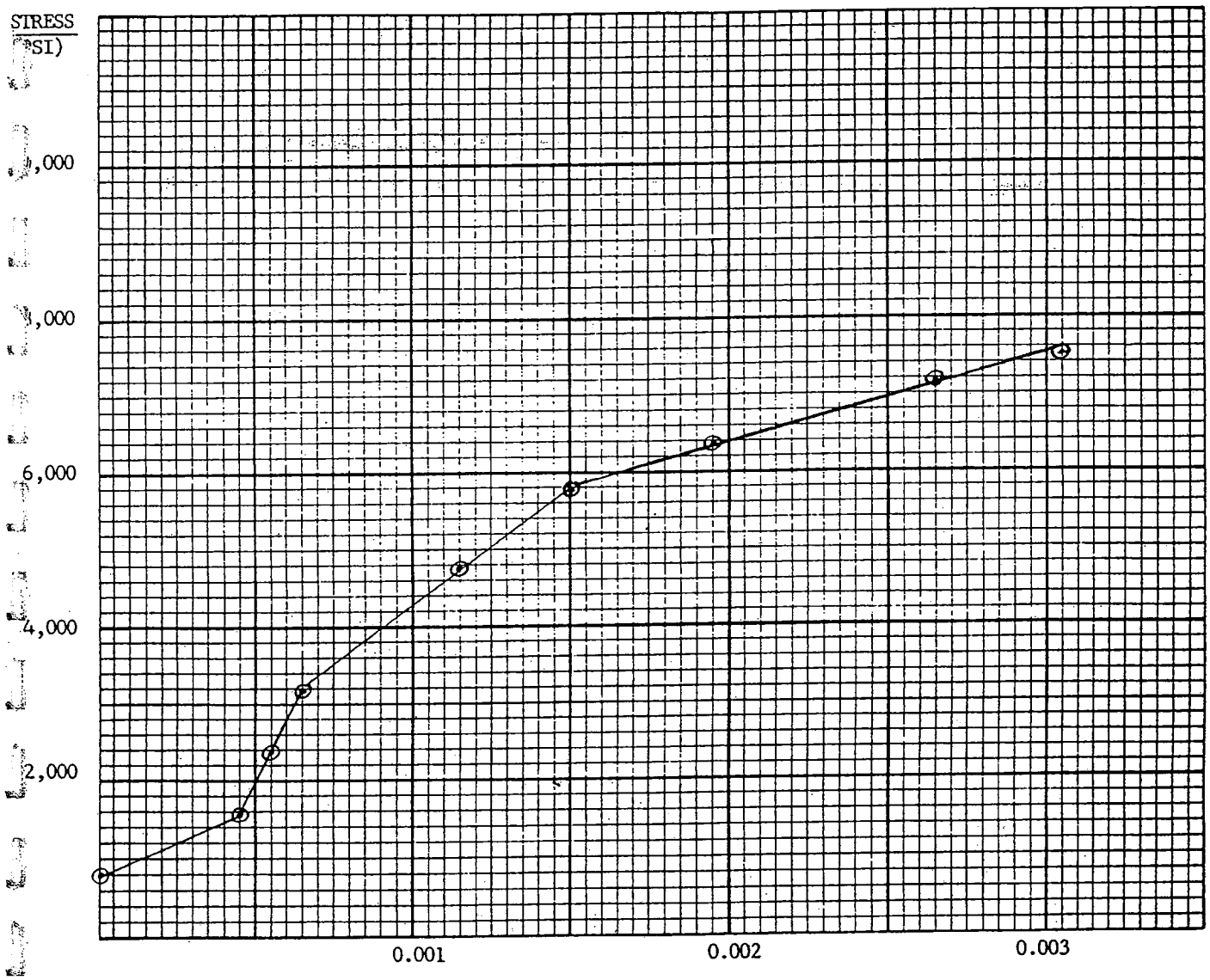
BORING NO.: B45



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 ☐

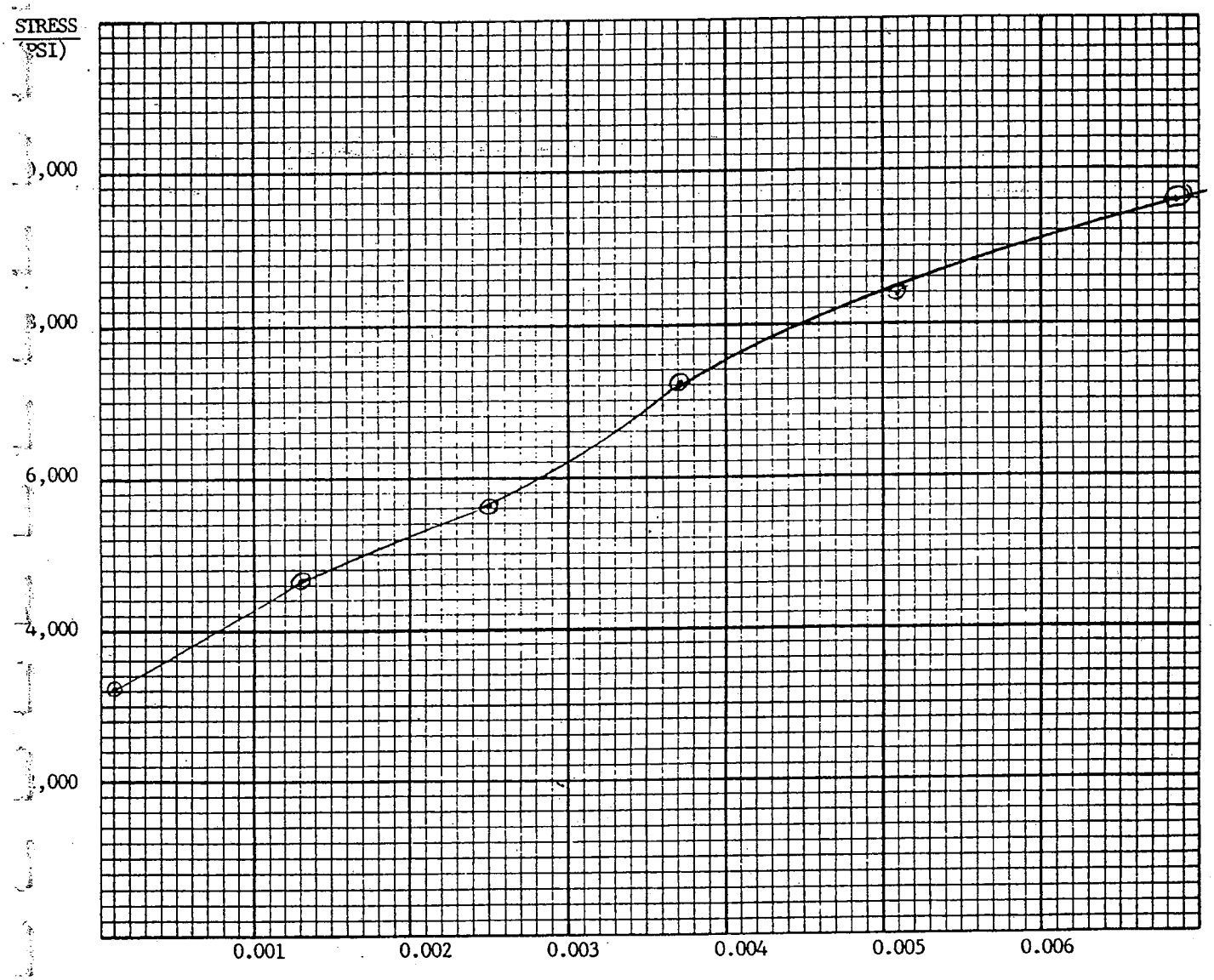
BORING NO.: B17



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

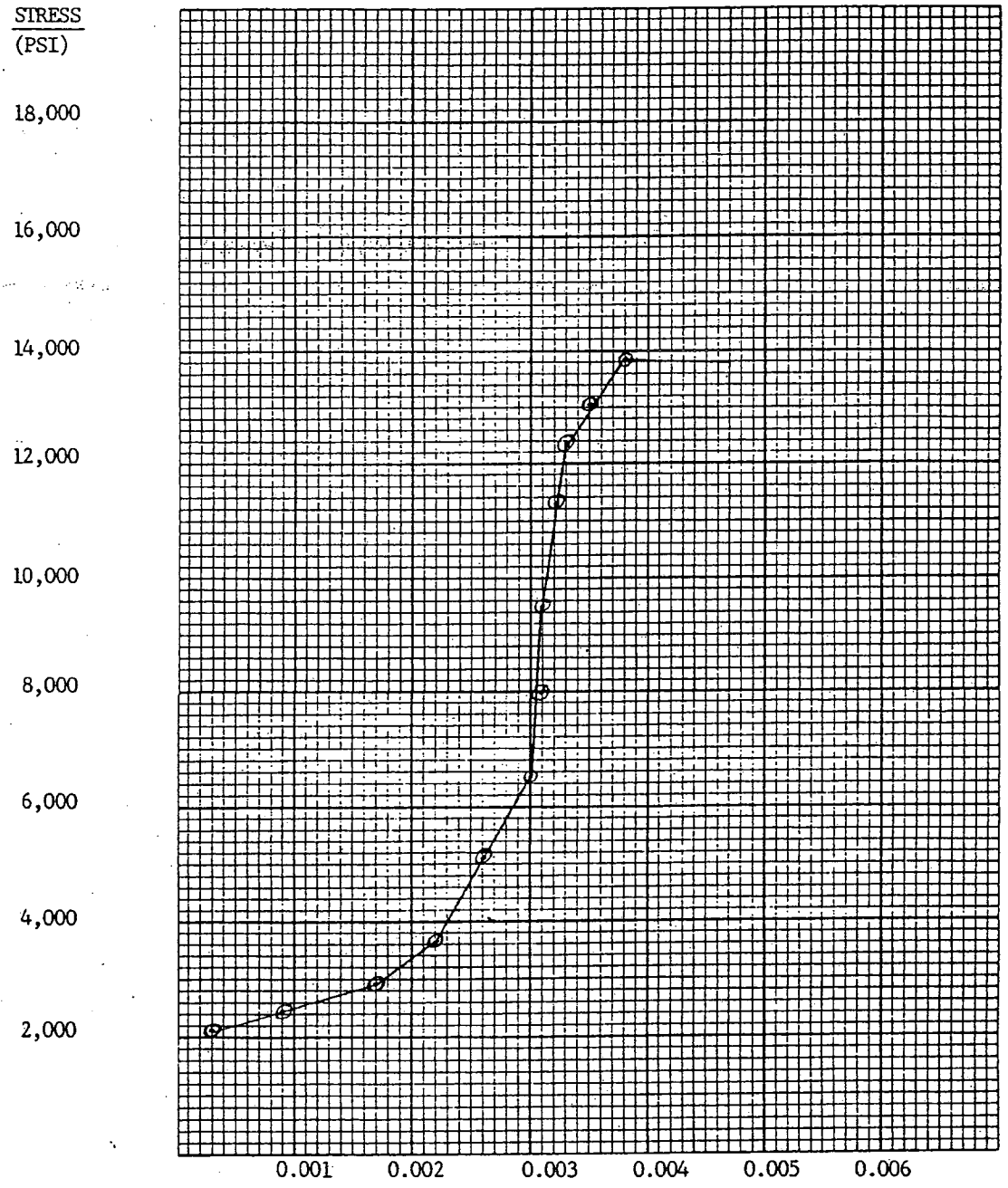
BORING NO.: B20



long island materials testing laboratories, inc.

N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-6000 — (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

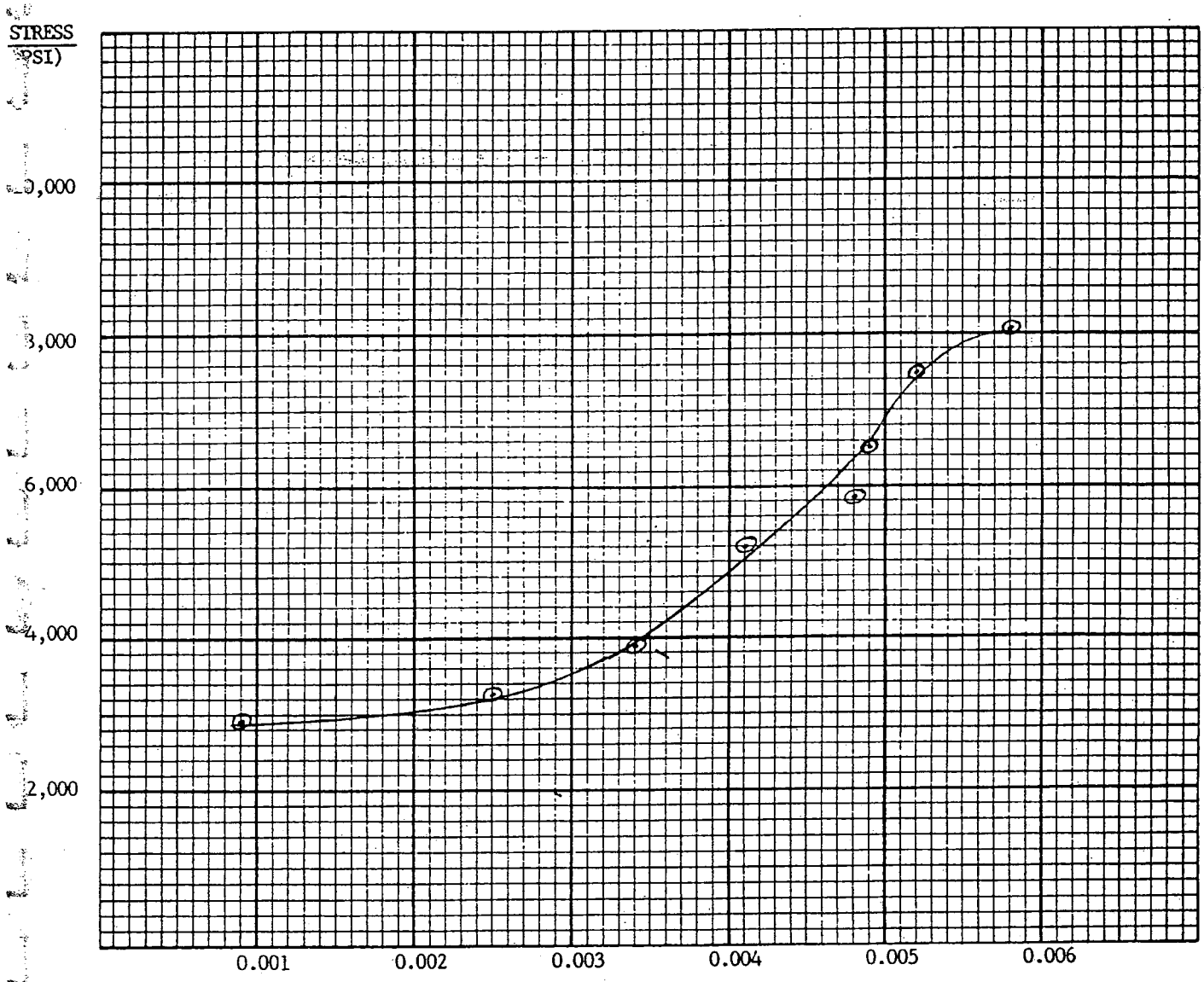
BORING NO.: B31



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

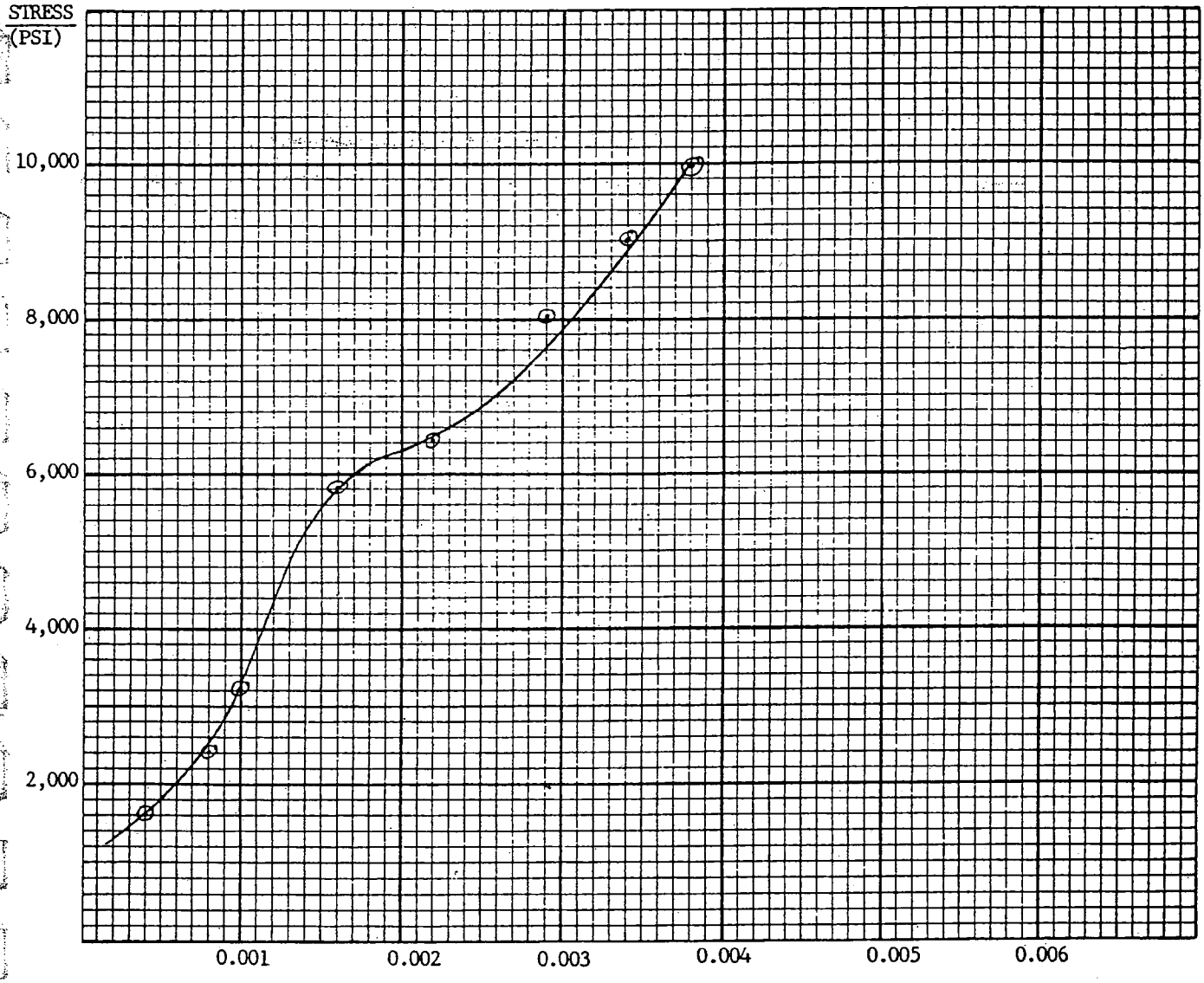
BORING NO.: B39



long island materials testing laboratories, inc.

X N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 ☐

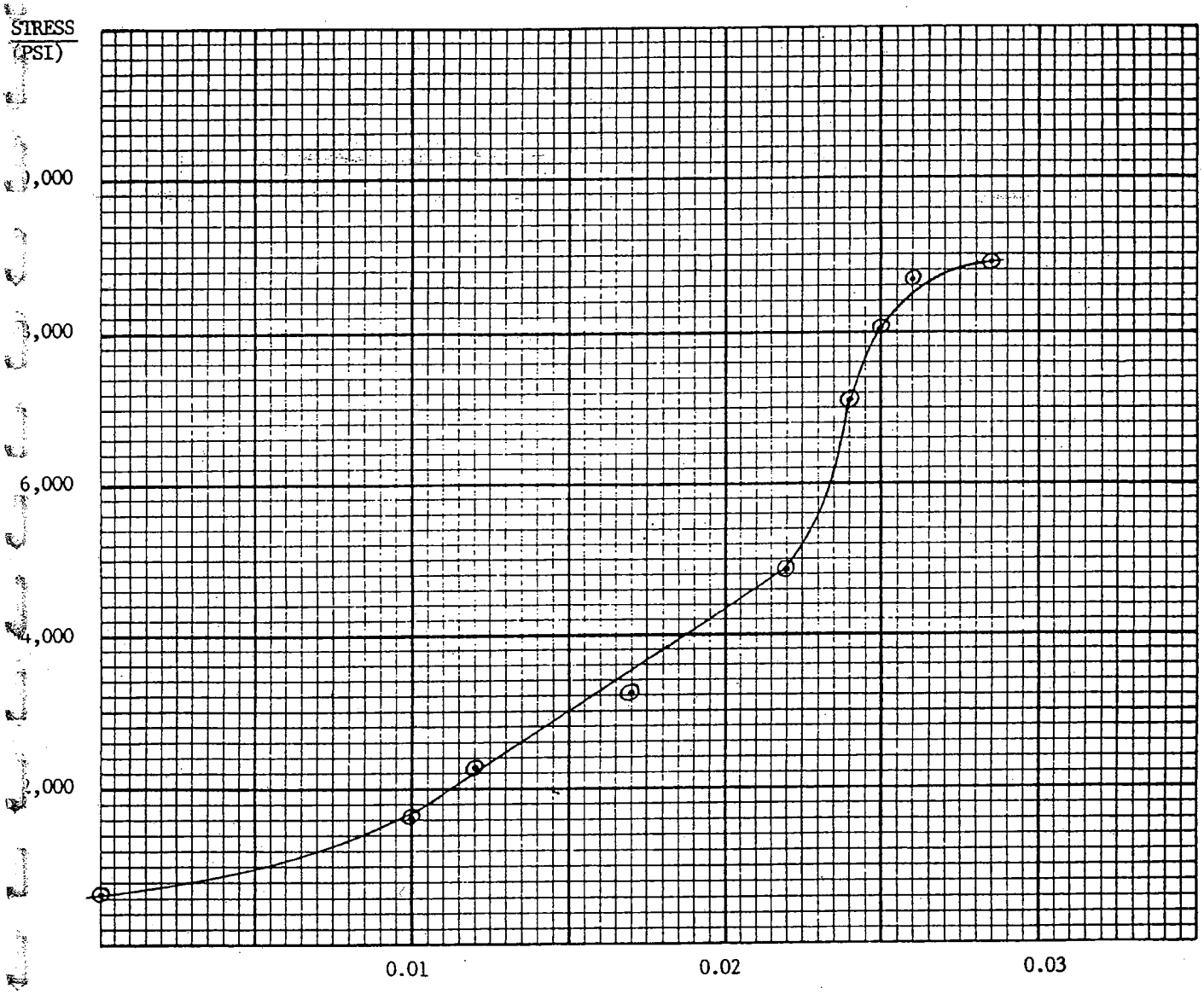
BORING NO.: B40



long island materials testing laboratories, inc.

[X] N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-8300 FAX (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725 [ ]

BORING NO.: B8

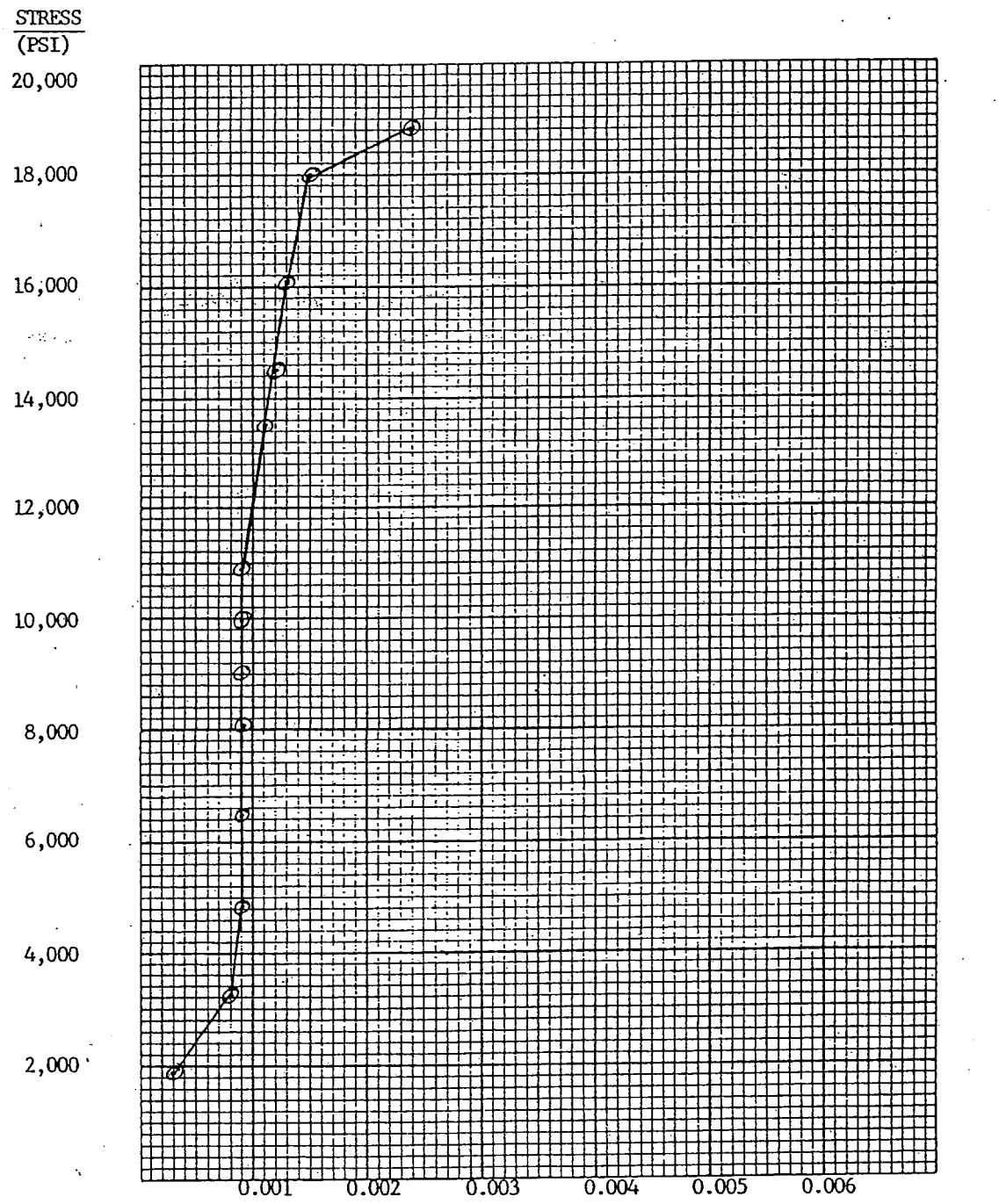


LATERAL STRAIN (in./in.)

long island materials testing laboratories, inc.

N.Y.C. OFFICE • P.O. BOX 233 • COLLEGE POINT, N.Y. 11356 • (718) 445-6000 — (718) 353-4713 LONG ISLAND OFFICE • P.O. BOX 787 • COMMACK, N.Y. 11725

BORING NO.: B19



THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX K

GROUNDWATER QUALITY ANALYSIS

THIS PAGE INTENTIONALLY LEFT BLANK

ACCUTEST.

04/13/99

Technical Report for

Metcalf & Eddy, Inc.

Mosholu G.C., Bronx, NY

013032

Accutest Job Number: E47323

Report to:

Metcalf & Eddy, Inc.
60 East 42nd Street
New York, NY 10165

ATTN: Harry Wackett

Total number of pages in report: 49

Vincent J. Pugliese
President

Certifications: NJ(12129), NY(10983), CA, CT, DE, FL, KS, MA, MD, NC, PA, RI, SC, VA

Results relate only to the items tested.

This report shall not be reproduced, except in its entirety, without the written approval of Accutest Laboratories.

ACCUTEST.

Sample Summary

Metcalf & Eddy, Inc.

Mosholu G.C., Bronx, NY
Project No: 013032

Date: 04/09/99
Job No: E47323

Sample Number	Collected Date	Time	By	Received	Matrix Code	Matrix Type	Client Sample ID
E47323-1	03/25/99	08:30	RK	03/25/99	AQ	Ground Water	MG-B29-99
E47323-2	03/25/99	09:30	RK	03/25/99	AQ	Ground Water	MG-B17-99
E47323-3	03/25/99	10:00	RK	03/25/99	AQ	Ground Water	MG-B5-99
E47323-4	03/25/99	13:00	RK	03/25/99	AQ	Ground Water	MG-B23-99
E47323-5	03/25/99	13:00	RK	03/25/99	AQ	Ground Water	MG-B30S-99
E47323-6	03/25/99	13:45	RK	03/25/99	AQ	Ground Water	MG-B45-99
E47323-7	03/25/99	14:00	RK	03/25/99	AQ	Ground Water	MG-B50-99
E47323-8	03/25/99	14:15	RK	03/25/99	AQ	Ground Water	MG-B36S-99

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732 329 0200 • fax: 732 329 3499 • http://www.accutest.com

ACCUTEST.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ANALYTICAL SERVICES PROTOCOL DELIVERABLES

NYDEC Laboratory Identification Number: 10983

1	Cover Page, Title Page Listing Certification Number, Facility Name & Date of Report	[✓]
2	Table of Contents	[✓]
3	Sample Preparation and Analysis Summaries	[✓]
4	Summary Sheets Listing Analytical Results For All Targeted and Non Targeted Compounds	[✓]
5	Summary Table Cross-Referencing Filed ID#s Vs Laboratory ID #s	[✓]
6	Chain of Custody	[✓]
7	Sample Login Sheet	[✓]
8	Methodology Summary	[✓]
9	Dry Weight Results (Where Applicable)	[✓]
10	Method Detection Limits (MDLs)	[✓]
11	Non-Conformance Summary	[✓]

Reviewer [signature] Date 4-8-99

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel 732 329 0200 • fax 732-329-3499 • http://www.accutest.com

ACCUTEST.

Table Of Contents
Reduced Laboratory Data Deliverables
For
Non-USEPA/CLP Methods

Title/Cover Page

Deliverable Checklist

Table Of Contents

Section 1 General

A. Results Summary
B. Chain of Custody
C. Laboratory Chronicles

Section 2 GC/MS Support Data (grouped by fraction)

A. Methodology Review
B. Conformance/Non-conformance Summary
C. Surrogate Recovery Results Summary
D. Matrix Spike/Matrix Spike Duplicate Summary
E. Method Blank Summary
F. Tune Results Summary
G. Calibration Summary (sorted by Instrument)
   - Initial Calibration Check Summary
   - Continuing Calibration Check Summary
H. Internal Standard Summary
I. Sample and Blank Chromatograms, Quant Reports, Mass Spectra, and Library Search Data

Section 3 GC Support Data

A. Methodology Review
B. Conformance/Non-conformance Summary
C. Surrogate Recovery Results Summary
D. Matrix Spike/Matrix Spike Duplicate Summary
E. Method Blank Summary
F. Calibration Summary (sorted by Instrument)
   - Initial Calibration Check Summary
   - Continuing Calibration Check Summary
G. Retention Time Shift Summary
H. Sample, Blank and Multi-peak Standard Chromatograms and Quant Reports

Section 4 Metals Support Data (sorted by Instrument Type - ICP, Furnace, Flame, Mercury)

A. Methodology Review
B. Conformance/Non-conformance Summary
C. Blank Results Summary
   - Initial and Continuing Calibration Blank Summary
   - Method Blank Summary
D. Batch Quality Control Summary
   - Matrix Spike and Duplicate Results Summary
   - Spike Blank and Lab Control Sample Summary
   - Serial Dilution Results Summary
E. Calibration Summary
   - Calibration Check Standards Summary
   - Interfering Elements Check Standard Summary

Section 5 General Chemistry/Petroleum Hydrocarbon Support Data

A. Methodology Review
B. Conformance/Non-Conformance Summary
C. Batch Quality Control Summary
   - Method Blank and Spike Blank Results Summary
   - Matrix Spike Results Summary
   - Duplicate Results Summary
D. Raw Data and IR Spectra (Petroleum Hydrocarbons)
E. Raw Data and Run Record (Hexavalent Chromium)

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B29-99		
Lab Sample ID:	E47323-1	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	1960	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	1610	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

4/5

RDL = Reported Detection Limit

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B29-99		
Lab Sample ID:	E47323-1	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed By	Method
Alkalinity, Total	67.2	5.0	mg/l	1	03/26/99 JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99 KY	SM16 409B
Nitrogen, Nitrate [a]	0.16	0.11	mg/l	1	03/28/99 MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	0.16	0.10	mg/l	1	03/28/99 MET	EPA 353.2
Nitrogen, Nitrite	<0.010	0.010	mg/l	1	03/26/99 KY	SM18 4500NO2B
Solids, Total Dissolved	149	10	mg/l	1	03/27/99 JK	EPA 160.1
pH	6.5		su	1	03/25/99 FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel. 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B17-99		
Lab Sample ID:	E47323-2	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	740	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	64.5	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton NJ 08810 • tel: 732 329 0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B17-99		
Lab Sample ID:	E47323-2	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed	By	Method
Alkalinity, Total	40.4	5.0	mg/l	1	03/26/99	JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99	KY	SM16 409B
Nitrogen, Nitrate [a]	<0.11	0.11	mg/l	1	03/28/99	MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	<0.10	0.10	mg/l	1	03/28/99	MET	EPA 353.2
Nitrogen, Nitrite	0.068	0.010	mg/l	1	03/26/99	KY	SM18 4500NO2B
Solids, Total Dissolved	105	10	mg/l	1	03/27/99	JK	EPA 160.1
pH	6.3		su	1	03/25/99	FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B5-99		
Lab Sample ID:	E47323-3	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	6350	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	152	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B5-99		
Lab Sample ID:	E47323-3	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed By	Method
Alkalinity, Total	58.8	5.0	mg/l	1	03/26/99 JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99 KY	SM16 409B
Nitrogen, Nitrate [a]	<0.11	0.11	mg/l	1	03/28/99 MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	<0.10	0.10	mg/l	1	03/28/99 MET	EPA 353.2
Nitrogen, Nitrite	0.015	0.010	mg/l	1	03/26/99 KY	SM18 4500NO2B
Solids, Total Dissolved	157	10	mg/l	1	03/27/99 JK	EPA 160.1
pH	7.1		su	1	03/25/99 FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel. 732 329 0200 • fax. 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B23-99		
Lab Sample ID:	E47323-4	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	2440	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	53.0	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732 329 0200 • fax: 732 329 3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B23-99		
Lab Sample ID:	E47323-4	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed	By	Method
Alkalinity, Total	65.6	5.0	mg/l	1	03/26/99	JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99	KY	SM16 409B
Nitrogen, Nitrate [a]	0.77	0.11	mg/l	1	03/28/99	MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	0.80	0.10	mg/l	1	03/28/99	MET	EPA 353.2
Nitrogen, Nitrite	0.032	0.010	mg/l	1	03/26/99	KY	SM18 4500NO2B
Solids, Total Dissolved	143	10	mg/l	1	03/27/99	JK	EPA 160.1
pH	9.7		su	1	03/25/99	FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B30S-99		
Lab Sample ID:	E47323-5	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	35900	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	490	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B30S-99		
Lab Sample ID:	E47323-5	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed	By	Method
Alkalinity, Total	432	5.0	mg/l	1	03/26/99	JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99	KY	SM16 409B
Nitrogen, Nitrate [a]	<0.11	0.11	mg/l	1	03/28/99	MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	0.18	0.10	mg/l	1	03/28/99	MET	EPA 353.2
Nitrogen, Nitrite	0.13	0.010	mg/l	1	03/26/99	KY	SM18 4500NO2B
Solids, Total Dissolved	780	10	mg/l	1	03/27/99	JK	EPA 160.1
pH	11.2		su	1	03/25/99	FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732 329-0200 • fax: 732 329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B45-99		
Lab Sample ID:	E47323-6	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	16000	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	2040	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732 329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B45-99		
Lab Sample ID:	E47323-6	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed By	Method
Alkalinity, Total	107	5.0	mg/l	1	03/26/99 JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99 KY	SM16 409B
Nitrogen, Nitrate [a]	<0.11	0.11	mg/l	1	03/28/99 MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	<0.10	0.10	mg/l	1	03/28/99 MET	EPA 353.2
Nitrogen, Nitrite	0.022	0.010	mg/l	1	03/26/99 KY	SM18 4500NO2B
Solids, Total Dissolved	220	10	mg/l	1	03/27/99 JK	EPA 160.1
pH	6.3		su	1	03/25/99 FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B50-99		
Lab Sample ID:	E47323-7	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	2650	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	169	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B50-99		
Lab Sample ID:	E47323-7	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed	By	Method
Alkalinity, Total	97.1	5.0	mg/l	1	03/26/99	JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99	KY	SM16 409B
Nitrogen, Nitrate [a]	0.16	0.11	mg/l	1	03/28/99	MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	0.16	0.10	mg/l	1	03/28/99	MET	EPA 353.2
Nitrogen, Nitrite	<0.010	0.010	mg/l	1	03/26/99	KY	SM18 4500NO2B
Solids, Total Dissolved	146	10	mg/l	1	03/27/99	JK	EPA 160.1
pH	9.0		su	1	03/25/99	FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B36S-99		
Lab Sample ID:	E47323-8	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

Metals Analysis

Analyte	Result	RDL	Units	DF	Prep	Analyzed	By	Method
Iron	135000	100	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7
Manganese	3630	15	ug/l	1	03/29/99	04/01/99	MFH	EPA 200.7

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

ACCUTEST.

Report of Analysis

Client Sample ID:	MG-B36S-99		
Lab Sample ID:	E47323-8	**Date Sampled:**	03/25/99
Matrix:	AQ - Ground Water	**Date Received:**	03/25/99
		Percent Solids:	n/a
Project:	Mosholu G.C., Bronx, NY		

General Chemistry

Analyte	Result	RDL	Units	DF	Analyzed	By	Method
Alkalinity, Total	224	5.0	mg/l	1	03/26/99	JX	EPA 310.1
Chlorine Demand	<0.50	0.50	mg/l	1	03/25/99	KY	SM16 409B
Nitrogen, Nitrate [a]	0.64	0.11	mg/l	1	03/28/99	MET	EPA353.2/SM184500
Nitrogen, Nitrate + Nitrite	0.78	0.10	mg/l	1	03/28/99	MET	EPA 353.2
Nitrogen, Nitrite	0.14	0.010	mg/l	1	03/26/99	KY	SM18 4500NO2B
Solids, Total Dissolved	172	10	mg/l	1	03/27/99	JK	EPA 160.1
pH	10.1		su	1	03/25/99	FAB	EPA 150.1

(a) Calculated as: (Nitrogen, Nitrate + Nitrite) - (Nitrogen, Nitrite)

RDL = Reported Detection Limit

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton, NJ 08810 • tel: 732-329-0200 • fax: 732-329-3499 • http://www.accutest.com

GW

ACCUTEST

CHAIN OF CUSTODY

FRESH PONDS CORPORATE VILLAGE, BUILDING B
2235 ROUTE 130, DAYTON, NJ 08810
732-329-0200 FAX: 732-329-3499/3480

ACCUTEST JOB #: E47323

ACCUTEST QUOTE #:

CLIENT INFORMATION

NAME: Metcalf & Eddy, Inc.
HARRY WACKETT
ADDRESS: 60 EAST 42ND St
CITY: NEW YORK STATE: NY ZIP: 10165
SEND REPORT TO:
PHONE #: 212 984-7368

FACILITY INFORMATION

PROJECT NAME: Mosholu G.C.
LOCATION: Bronx, NY
PROJECT NO.: 013032
FAX #:

ANALYTICAL INFORMATION

ACCUTEST SAMPLE #	FIELD ID / POINT OF COLLECTION	COLLECTION DATE	COLLECTION TIME	SAMPLED BY:	MATRIX	# OF BOTTLES	PRESERVATION HCl	NaOH	HNO3	H2SO4	NONE	PH	TDS	CLD	NO2	ALK	FE	MN	NO3	RADON		LAB USE ONLY
-1	MG-B29-99	3/25/99	0830	Kent	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	Ph=6.5	
-2	MG-B17-99	3/25/99	0930	Kent	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	6.3	
-3	MG-B5-99	3/25/99	1000	Kent	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	7.1	
-4	MG-B23-99	3/25/99	1300	Kent	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	9.7	
-5	~~MG-B30-99~~ MG-B30S-99	3/25/99	1300	Acs	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	11.2	
-6	MG-B45-99	3/25/99	1345	Kent	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	6.3	
-7	MG-B50-99	3/25/99	14:00	Acs	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	9.0	
-8	~~MG-B36-99~~ MG-B36S-99	3/25/99	1415	Kent	GW	4			✓	✓	2	X	X	X	X	X	X	X	X	X	10.1	

NYASP Bruno 3/26/99

RED/T2

TW; II; SUB

MATRIX CODES

DW - DRINKING WATER
GW - GROUND WATER
WW - WASTE WATER
SO - SOIL
SL - SLUDGE
OI - OIL
LIQ - OTHER LIQUID
SOL - OTHER SOLID

DATA TURNAROUND INFORMATION

- [x] 21 DAYS STANDARD
- [ ] 14 DAYS *RUSH*
- [ ] 7 DAYS *EMERGENCY*
- [ ] OTHER

APPROVED BY:

21 DAY TURNAROUND HARDCOPY. EMERGENCY OR RUSH IS FAX DATA UNLESS PREVIOUSLY APPROVED

DATA DELIVERABLE INFORMATION

- [ ] NJ REDUCED
- [ ] NJ Full
- [ ] FULL CLP
- [ ] DISK DELIVERABLE
- [x] OTHER (SPECIFY) NYDEC
- [ ] COMMERCIAL "A"
- [ ] COMMERCIAL "B"
- [x] STATE FORMS

NY STATE REPORTABLE

COMMENTS/REMARKS

RADON SERIAL #S (B29)-61929; (B17) 61932
(B5) 61921; (B23) 61931; (B30) 61930
(B45) 61927; (B36) 61934; (B50) 61923

SAMPLE CUSTODY MUST BE DOCUMENTED BELOW EACH TIME SAMPLES CHANGE POSSESION, INCLUDING COURIER DELIVERY

RELINQUISHED BY SAMPLER:	DATE TIME:	RECEIVED BY:	RELINQUISHED BY:	DATE TIME:	RECEIVED BY:
1. [signature]	3/25/99 1500	1. Michael G. Macy	2. Michael G. Macy	3-25-99 1501	2. [signature]
RELINQUISHED BY: 3.	DATE TIME:	RECEIVED BY: 3.	RELINQUISHED BY: 4.	DATE TIME:	RECEIVED BY: 4.
RELINQUISHED BY:	DATE TIME:	RECEIVED BY:	SEAL #	PRESERVE WHERE APPLICABLE	ON ICE / TEMPERATURE

Accutest
Job Change Order

Request Date/Time: 4/5/99 @ 2:00
Client: Metcalf & Eddy
Phone #:

Accutest Job No. E47323
Client Project:
CSR: DJM
Delv:

Sample #:	Change:
E47323	Change Delv from ASP CAT B to REDT2 No State Forms needed.

Above Changes Per: Eric Axe Date: 4/5/99

To Client: This Change Order is confirmation of the revisions, previously discussed with the Accutest Client Service Representative

CHAIN OF CUSTODY

ACCUTEST

Fresh Ponds Corporate Village, Building B
2235 Route 130, Dayton, NJ 08810
908-329-0200 FAX: 908-329-3499/3480

Accutest Job #:

Accutest Quote #:

Client Information	Facility Information
RA Data	
Name: 27 Ironia Road, Unit #2	Project Name:
Address: Flanders NJ 07836	Location:
City: Sample Management State: Zip:	Project No.: E47323
Send Report to: Marie Rutsky	
Phone #: (732) 329-0200 X-228	FAX #: (732) 329-3499

Field ID / Point of Collection	Collection Date	Collection Time	Sampled By	Matrix	# of bottles	Preservation HCL	NaOH	HNO3	H2So4	None	Radon	Radata Vial #	Analytical Information		
E47323 -1 ~~thru 8~~	3/29/99	0830		~~DW~~ Low	1					X	X	61929			
-2	↓	0930		↓	↓					↓	↓	61932			
-3	↓	1000		↓	↓					↓	↓	61921			
-4	↓	1300		↓	↓					↓	↓	61931			
-5	↓	↓		↓	↓					↓	↓	61930			
-6	↓	1345		↓	↓					↓	↓	61927			
-7	↓	1400		↓	↓					↓	↓	61923			
-8	↓	1415		↓	↓					↓	↓	61934			
-															
-															

Turnaround Information

- [ ] 21 Day Standard
- [ ] 14 Day
- [ ] 7 Days *EMERGENCY*
- [X] Other 21 (Days)

Approved By:

21 Day Turnaround Hardcopy, Emergency or RUSH is FAX Data unless previously approved.

Data Deliverable Information

- [X] NJ Reduced
- [ ] NJ Full
- [ ] FULL CLP
- [ ] Disk Deliverable
- [ ] Other (Specify)
- [ ] Commercial "A"
- [ ] Commercial "B"
- [ ] State Forms

Comments / Remarks

Sample Custody must be documented below each time samples change possesion, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1 [signature]	3/29/99 1700	1 FedX 4295 5356 6601	2		2
3		3	4		4
5		5	Seal #	Preserved where applicable ☐	On Ice ☐

23

Accutest
Subcontractor Order

Date/Time:	3/29/99 3:29 PM	**Sub Lab:**	RA Data
Accutest Job No.	E47323	**Address:**	27 Ironia Road, Unit#2
Client Project:			Flanders NJ 07836
CSR:	DJM	**Contact:**	Sample Management
		Phone:	(973) 927-7303

Sample #:	Analyses
E47323 - 1 thru 8	Radon
Turn Around	21

Sample Managment receipt: _____ Date: 3/29/99

(Print form and sign/date. Submit this form to Login Dept. with the SUB COC.)

e/sop_new/subform

ACCUTEST.

Metals Analysis Case Narrative/Conformance/Non-Conformance Summary

		NO	YES
1.	Blank levels below reporting limits?	[ ]	[√]
	If no, list elements above reporting limits :		
2.	Spike blank or lab control data within acceptable limits?	[ ]	[√]
	If no, list elements outside of acceptable limits. Refer to QC summary for additional comments :		
3.	Matrix Spike data within acceptable limits?	[ ]	[√]
	If no, list elements outside of acceptable limits. Refer to QC summary for additional comments :		
4.	Matrix duplicate data within acceptable limits?.	[ ]	[√]
	If no, list elements outside of acceptable limits. Refer to QC summary for additional comments :		
5.	Samples digested and analyzed within holding time?	[ ]	[√]
	If holding times were not met, list elements where holding times were exceeded and explain:		
6.	All analytical criteria met (calibrations, CCV and CCB checks, interfering element checks, etc.)?	[ ]	[√]
	If not met, list affected samples and elements:		

Additional Comments:

QC Review Signature: Johnetta Scott Date: 4-7-99

New Jersey • ... • Building B • 2235 Route 130 • Dayton NJ 08810 • tel 908 ... 0200 • fax 908 329 3499 • ...

BLANK RESULTS SUMMARY
Part 1 - Initial and Continuing Calibration Blanks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC
QC Limits: result < RDL

Date Analyzed: 03/31/99
Run ID: MA5864

Methods: EPA 200.7, SW846 6010B
Units: ug/l

Metal	RDL	IDL	ICB raw	final	CCB raw	final	CCB raw	final	CCB raw	final
Aluminum	200	47.2	anr							
Antimony	5.0	3.1	anr							
Arsenic	5.0	3.3	anr							
Barium	200	.4	anr							
Beryllium	5.0	.3	anr							
Boron	100	4	anr							
Cadmium	4.0	.3	anr							
Calcium	5000	11.3	anr							
Chromium	10	1.9	anr							
Cobalt	50	.6	anr							
Copper	25	.8	anr							
Iron	100	41.7	-21	<100	-14	<100	-1.9	<100	-14	<100
Lead	3.0	1.3	anr							
Magnesium	5000	5.7	anr							
Manganese	15	.4	-0.51	<15	0.19	<15	0.20	<15	-0.040	<15
Molybdenum	5.0	.8	anr							
Nickel	40	1.3	anr							
Palladium	50	2.3	anr							
Potassium	5000	33.6	anr							
Selenium	5.0	3.5	anr							
Silicon	200	16.2	anr							
Silver	10	.5	anr							
Sodium	5000	239	anr							
Strontium	10	.2	anr							
Thallium	5.0	3.5	anr							
Tin	10	2.4	anr							
Titanium	10	.8	anr							
Vanadium	50	.4	anr							
Zinc	20	1.2	anr							

(*) Outside of QC limits
(anr) Analyte not requested

BLANK RESULTS SUMMARY
Part 1 - Initial and Continuing Calibration Blanks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC
QC Limits: result < RDL

Date Analyzed: 03/31/99
Run ID: MA5864

Methods: EPA 200.7, SW846 6010B
Units: ug/l

Metal	RDL	IDL	CCB raw	final	CCB raw	final	CCB raw	final	CCB raw	final
Aluminum	200	47.2	anr							
Antimony	5.0	3.1	anr							
Arsenic	5.0	3.3	anr							
Barium	200	.4	anr							
Beryllium	5.0	.3	anr							
Boron	100	4	anr							
Cadmium	4.0	.3	anr							
Calcium	5000	11.3	anr							
Chromium	10	1.9	anr							
Cobalt	50	.6	anr							
Copper	25	.8	anr							
Iron	100	41.7	-6.4	<100	-20	<100	-16	<100	-11	<100
Lead	3.0	1.3	anr							
Magnesium	5000	5.7	anr							
Manganese	15	.4	0.30	<15	0.00	<15	-0.17	<15	-0.21	<15
Molybdenum	5.0	.8	anr							
Nickel	40	1.3	anr							
Palladium	50	2.3	anr							
Potassium	5000	33.6	anr							
Selenium	5.0	3.5	anr							
Silicon	200	16.2	anr							
Silver	10	.5	anr							
Sodium	5000	239	anr							
Strontium	10	.2	anr							
Thallium	5.0	3.5	anr							
Tin	10	2.4	anr							
Titanium	10	.8	anr							
Vanadium	50	.4	anr							
Zinc	20	1.2	anr							

(*) Outside of QC limits
(anr) Analyte not requested

BLANK RESULTS SUMMARY
Part 1 - Initial and Continuing Calibration Blanks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC
QC Limits: result < RDL

Date Analyzed: 03/31/99
Run ID: MA5864

Methods: EPA 200.7, SW846 6010B
Units: ug/l

Metal	RDL	IDL	CCB raw	final	CCB raw	final
Aluminum	200	47.2	anr			
Antimony	5.0	3.1	anr			
Arsenic	5.0	3.3	anr			
Barium	200	.4	anr			
Beryllium	5.0	.3	anr			
Boron	100	4	anr			
Cadmium	4.0	.3	anr			
Calcium	5000	11.3	anr			
Chromium	10	1.9	anr			
Cobalt	50	.6	anr			
Copper	25	.8	anr			
Iron	100	41.7	-16	<100	-20	<100
Lead	3.0	1.3	anr			
Magnesium	5000	5.7	anr			
Manganese	15	.4	0.00	<15	-0.32	<15
Molybdenum	5.0	.8	anr			
Nickel	40	1.3	anr			
Palladium	50	2.3	anr			
Potassium	5000	33.6	anr			
Selenium	5.0	3.5	anr			
Silicon	200	16.2	anr			
Silver	10	.5	anr			
Sodium	5000	239	anr			
Strontium	10	.2	anr			
Thallium	5.0	3.5	anr			
Tin	10	2.4	anr			
Titanium	10	.8	anr			
Vanadium	50	.4	anr			
Zinc	20	1.2	anr			

(*) Outside of QC limits
(anr) Analyte not requested

BLANK RESULTS SUMMARY
Part 2 - Method Blanks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

QC Batch ID: MP8688
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 03/29/99

Metal	RDL	IDL	MB raw	final
Aluminum	200	47.2	anr	
Antimony	5.0	3.1	anr	
Arsenic	5.0	3.3	anr	
Barium	200	.4	anr	
Beryllium	5.0	.3	anr	
Boron	100	4	anr	
Cadmium	4.0	.3	anr	
Calcium	5000	11.3	anr	
Chromium	10	1.9	anr	
Cobalt	50	.6	anr	
Copper	25	.8	anr	
Iron	100	41.7	-9.7	<100
Lead	3.0	1.3	anr	
Magnesium	5000	5.7	anr	
Manganese	15	.4	-0.26	<15
Molybdenum	5.0	.8	anr	
Nickel	40	1.3	anr	
Palladium	50	2.3	anr	
Potassium	5000	33.6	anr	
Selenium	5.0	3.5	anr	
Silicon	200	16.2	anr	
Silver	10	.5	anr	
Sodium	5000	239	anr	
Strontium	10	.2	anr	
Thallium	5.0	3.5	anr	
Tin	10	2.4	anr	
Titanium	10	.8	anr	
Vanadium	50	.4	anr	
Zinc	20	1.2	anr	

Associated samples MP8688: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

QC Batch ID: MP8688
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date:		03/29/99				03/29/99			
Metal	E47323-6 Original	DUP	RPD	QC Limits	E47323-6 Original	MS	Spikelot MPIRW1	% Rec	QC Limits
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Boron									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron	16000	16000	0.0	0-27	16000	16800	1000	80.0	27-169
Lead	anr								
Magnesium									
Manganese	2040	2030	0.5	0-27	2040	2480	500	88.0	63-133
Molybdenum									
Nickel									
Palladium									
Potassium									
Selenium									
Silicon									
Silver									
Sodium									
Strontium									
Thallium									
Tin									
Titanium									
Vanadium									
Zinc									

Associated samples MP8688: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

MATRIX SPIKE AND DUPLICATE RESULTS SUMMARY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

QC Batch ID: MP8688
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 03/29/99

Metal	E47323-7 Original	DUP	RPD	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron	2650	2550	3.8	0-27
Lead	anr			
Magnesium				
Manganese	169	168	0.6	0-27
Molybdenum				
Nickel				
Palladium				
Potassium				
Selenium				
Silicon				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Vanadium				
Zinc				

Associated samples MP8688: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(N) Matrix Spike Rec. outside of QC limits
(anr) Analyte not requested

SPIKE BLANK AND LAB CONTROL SAMPLE SUMMARY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

QC Batch ID: MP8688
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 03/29/99

Metal	LCS Result	Spikelot MPLCW2	% Rec	QC Limits
Aluminum	anr			
Antimony	anr			
Arsenic	anr			
Barium	anr			
Beryllium	anr			
Boron				
Cadmium	anr			
Calcium	anr			
Chromium	anr			
Cobalt	anr			
Copper	anr			
Iron	5860	5500	106.5	80-120
Lead	anr			
Magnesium	anr			
Manganese	509	500	101.8	80-120
Molybdenum	anr			
Nickel	anr			
Palladium				
Potassium	anr			
Selenium	anr			
Silicon				
Silver	anr			
Sodium	anr			
Strontium				
Thallium	anr			
Tin				
Titanium	anr			
Vanadium	anr			
Zinc	anr			

Associated samples MP8688: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

SERIAL DILUTION RESULTS SUMMARY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

QC Batch ID: MP8688
Matrix Type: AQUEOUS

Methods: EPA 200.7
Units: ug/l

Prep Date: 03/29/99

Metal	E47323-6 Original	SDL 1:5	RPD	QC Limits
Aluminum				
Antimony				
Arsenic				
Barium				
Beryllium				
Boron				
Cadmium				
Calcium				
Chromium				
Cobalt				
Copper				
Iron	16000	16200	1.2	0-10
Lead	anr			
Magnesium				
Manganese	2040	2060	0.8	0-10
Molybdenum				
Nickel				
Palladium				
Potassium				
Selenium				
Silicon				
Silver				
Sodium				
Strontium				
Thallium				
Tin				
Titanium				
Vanadium				
Zinc				

Associated samples MP8688: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

Results < IDL are shown as zero for calculation purposes
(*) Outside of QC limits
(anr) Analyte not requested

CALIBRATION CHECK STANDARDS SUMMARY
Initial and Continuing Calibration Checks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 95 to 105 % Recovery Run ID: MA5864 Units: ug/l

Metal	ICV True	ICV Results	% Rec	ICV True	ICV Results	% Rec	ICV True	ICV Results	% Rec
Aluminum	anr								
Antimony	anr								
Arsenic	anr								
Barium	anr								
Beryllium	anr								
Boron	anr								
Cadmium	anr								
Calcium	anr								
Chromium	anr								
Cobalt	anr								
Copper	anr								
Iron	5000	5040	100.8						
Lead	anr								
Magnesium	anr								
Manganese	1000	981	98.1						
Molybdenum	anr								
Nickel	anr								
Palladium	anr								
Potassium									
Selenium	anr								
Silicon									
Silver	anr								
Sodium									
Strontium	anr								
Thallium	anr								
Tin	anr								
Titanium	anr								
Vanadium	anr								
Zinc	anr								

(*) Outside of QC limits
(anr) Analyte not requested

CALIBRATION CHECK STANDARDS SUMMARY
Initial and Continuing Calibration Checks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 95 to 105 % Recovery Run ID: MA5864 Units: ug/l

Metal	ICV True	ICV Results	% Rec	CCV True	CCV Results	% Rec	CCV True	CCV Results	% Rec
Aluminum									
Antimony									
Arsenic									
Barium									
Beryllium									
Boron									
Cadmium									
Calcium									
Chromium									
Cobalt									
Copper									
Iron				40000	41500	103.8	40000	39500	98.8
Lead									
Magnesium									
Manganese				2000	2030	101.5	2000	1940	97.0
Molybdenum									
Nickel									
Palladium									
Potassium	anr								
Selenium									
Silicon									
Silver									
Sodium									
Strontium									
Thallium									
Tin									
Titanium									
Vanadium									
Zinc									

(*) Outside of QC limits
(anr) Analyte not requested

CALIBRATION CHECK STANDARDS SUMMARY
Initial and Continuing Calibration Checks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 95 to 105 % Recovery Run ID: MA5864 Units: ug/l

Metal	CCV True	CCV Results	% Rec	CCV True	CCV Results	% Rec	CCV True	CCV Results	% Rec
Aluminum	anr								
Antimony	anr								
Arsenic	anr								
Barium	anr								
Beryllium	anr								
Boron	anr								
Cadmium	anr								
Calcium	anr								
Chromium	anr								
Cobalt	anr								
Copper	anr								
Iron	40000	39200	98.0	40000	41400	103.5	40000	41500	103.8
Lead	anr								
Magnesium	anr								
Manganese	2000	1910	95.5	2000	1970	98.5	2000	1980	99.0
Molybdenum	anr								
Nickel	anr								
Palladium	anr								
Potassium	anr								
Selenium	anr								
Silicon	anr								
Silver	anr								
Sodium	anr								
Strontium	anr								
Thallium	anr								
Tin	anr								
Titanium	anr								
Vanadium	anr								
Zinc	anr								

(*) Outside of QC limits
(anr) Analyte not requested

CALIBRATION CHECK STANDARDS SUMMARY
Initial and Continuing Calibration Checks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 95 to 105 % Recovery Run ID: MA5864 Units: ug/l

Metal	CCV True	CCV Results	% Rec	CCV True	CCV Results	% Rec	CCV True	CCV Results	% Rec
Aluminum	anr								
Antimony	anr								
Arsenic	anr								
Barium	anr								
Beryllium	anr								
Boron	anr								
Cadmium	anr								
Calcium	anr								
Chromium	anr								
Cobalt	anr								
Copper	anr								
Iron	40000	41500	103.8	40000	40200	100.5	40000	42000	105.0
Lead	anr								
Magnesium	anr								
Manganese	2000	1970	98.5	2000	1930	96.5	2000	2030	101.5
Molybdenum	anr								
Nickel	anr								
Palladium	anr								
Potassium	anr								
Selenium	anr								
Silicon	anr								
Silver	anr								
Sodium	anr								
Strontium	anr								
Thallium	anr								
Tin	anr								
Titanium	anr								
Vanadium	anr								
Zinc	anr								

(*) Outside of QC limits
(anr) Analyte not requested

CALIBRATION CHECK STANDARDS SUMMARY
Initial and Continuing Calibration Checks

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC
QC Limits: 95 to 105 % Recovery

Date Analyzed: 03/31/99
Run ID: MA5864

Methods: EPA 200.7, SW846 6010B
Units: ug/l

Metal	CCV True	CCV Results	% Rec
Aluminum	anr		
Antimony	anr		
Arsenic	anr		
Barium	anr		
Beryllium	anr		
Boron	anr		
Cadmium	anr		
Calcium	anr		
Chromium	anr		
Cobalt	anr		
Copper	anr		
Iron	40000	41200	103.0
Lead	anr		
Magnesium	anr		
Manganese	2000	2010	100.5
Molybdenum	anr		
Nickel	anr		
Palladium	anr		
Potassium	anr		
Selenium	anr		
Silicon	anr		
Silver	anr		
Sodium	anr		
Strontium	anr		
Thallium	anr		
Tin	anr		
Titanium	anr		
Vanadium	anr		
Zinc	anr		

(*) Outside of QC limits
(anr) Analyte not requested

HIGH STANDARD CHECK SUMMARY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 95 to 105 % Recovery Run ID: MA5864 Units: ug/l

Metal	HSTD True	HSTD Results	% Rec
Aluminum	anr		
Antimony	anr		
Arsenic	anr		
Barium	anr		
Beryllium	anr		
Boron	anr		
Cadmium	anr		
Calcium	anr		
Chromium	anr		
Cobalt	anr		
Copper	anr		
Iron	80000	78900	98.6
Lead	anr		
Magnesium	anr		
Manganese	4000	3920	98.0
Molybdenum	anr		
Nickel	anr		
Palladium	anr		
Potassium	anr		
Selenium	anr		
Silicon	anr		
Silver	anr		
Sodium	anr		
Strontium	anr		
Thallium	anr		
Tin	anr		
Titanium	anr		
Vanadium	anr		
Zinc	anr		

(*) Outside of QC limits
(anr) Analyte not requested

INTERFERING ELEMENT CHECK STANDARDS SUMMARY
Part 1 - ICSA and ICSAB Standards

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 80 to 120 % Recovery Run ID: MA5864 Units: ug/l

Metal	ICSA True	ICSAB True	ICSA Results	% Rec	ICSAB Results	% Rec	ICSA Results	% Rec	ICSAB Results	% Rec
Aluminum	500000	500000	502000	100.4	503000	100.6	490000	98.0	493000	98.6
Antimony		1000	-4.2		995	99.5	-3.8		996	99.6
Arsenic		1000	-2.2		1020	102.0	1.1		1050	105.0
Barium		500	2.3		536	107.2	1.8		506	101.2
Beryllium		500	-1.1		499	99.8	-0.97		520	104.0
Boron			0.14		15.6		-0.12		14.8	
Cadmium		1000	-0.71		913	91.3	0.82		962	96.2
Calcium	500000	500000	455000	91.0	460000	92.0	468000	93.6	480000	96.0
Chromium		500	2.0		473	94.6	-1.7		488	97.6
Cobalt		500	1.4		454	90.8	1.4		470	94.0
Copper		500	1.4		557	111.4	2.5		534	106.8
Iron	200000	200000	194000	97.0	189000	94.5	200000	100.0	197000	98.5
Lead		1000	-1.9		903	90.3	2.5		957	95.7
Magnesium	500000	500000	539000	107.8	536000	107.2	557000	111.4	560000	112.0
Manganese		500	-1.7		480	96.0	-2.6		486	97.2
Molybdenum		500	0.31		491	98.2	-0.52		507	101.4
Nickel		1000	1.2		892	89.2	-2.5		926	92.6
Palladium		500	-1.2		547	109.4	-2.2		530	106.0
Potassium			3.0		6.1		-4.7		3.3	
Selenium		1000	3.9		1010	101.0	7.8* (a)		1050	105.0
Silicon			16.6		176		26.3		172	
Silver		1000	-0.51		1080	108.0	-0.28		1050	105.0
Sodium			398		127		358		-35	
Strontium			-0.27		-0.37		-0.56		-0.58	
Thallium		1000	-1.0		873	87.3	-0.97		891	89.1
Tin			1.0		3.4		1.7		1.8	
Titanium			1.3		1.3		1.3		1.1	
Vanadium		500	0.10		492	98.4	-0.74		496	99.2
Zinc		1000	3.8		867	86.7	2.8		945	94.5

(*) Outside of QC limits
(anr) Analyte not requested
(a) Within RDL limits for soils. No aqueous samples reported for this element bracketed by this QC.

INTERFERING ELEMENT CHECK STANDARDS SUMMARY
Part 1 - ICSA and ICSAB Standards

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

File ID: IP0331M2.ASC Date Analyzed: 03/31/99 Methods: EPA 200.7, SW846 6010B
QC Limits: 80 to 120 % Recovery Run ID: MA5864 Units: ug/l

Metal	ICSA True	ICSAB True	ICSA Results	% Rec	ICSAB Results	% Rec
Aluminum	500000	500000	482000	96.4	493000	98.6
Antimony		1000	-0.23		1020	102.0
Arsenic		1000	-6.2*(a)		1100	110.0
Barium		500	1.8		503	100.6
Beryllium		500	0.12		535	107.0
Boron			19.8		22.5	
Cadmium		1000	-2.4		1030	103.0
Calcium	500000	500000	496000	99.2	507000	101.4
Chromium		500	-1.4		508	101.6
Cobalt		500	1.4		492	98.4
Copper		500	0.74		519	103.8
Iron	200000	200000	207000	103.5	205000	102.5
Lead		1000	1.5		1010	101.0
Magnesium	500000	500000	581000	116.2	586000	117.2
Manganese		500	-2.5		508	101.6
Molybdenum		500	-0.14		513	102.6
Nickel		1000	-2.7		974	97.4
Palladium		500	-0.50		523	104.6
Potassium			-0.39		-4.0	
Selenium		1000	8.7* (a)		1090	109.0
Silicon			13.7		178	
Silver		1000	0.10		1070	107.0
Sodium			460		195	
Strontium			-0.79		-0.82	
Thallium		1000	0.15		938	93.8
Tin			0.76		1.3	
Titanium			1.5		1.4	
Vanadium		500	-0.33		513	102.6
Zinc		1000	2.1		1060	106.0

(*) Outside of QC limits
(anr) Analyte not requested
(a) Within RDL limits for soils. No aqueous samples reported for this element bracketed by this QC.

ACCUTEST.

General Chemistry Case Narrative/Conformance/Non-Conformance Summary

	NO	YES
1. Blank levels below reporting limits?	[ ]	[√]

If no, list analytes above reporting limits : _____

2. Spike blank or lab control data within acceptable limits?	[ ]	[√]

If no, list analytes outside of acceptable limits. Refer to QC summary for additional comments : _____

3. Matrix Spike data within acceptable limits?	[ ]	[√]

If no, list analytes outside of acceptable limits. Refer to QC summary for additional comments : _____

4. Matrix duplicate data within acceptable limits?.	[ ]	[√]

If no, list analytes outside of acceptable limits. Refer to QC summary for additional comments : _____

5. Samples prepared and analyzed within holding time?	[ ]	[√]

If holding times were not met, list analytess where holding times were exceeded and explain: _____

6. All analytical criteria met (calibrations, CCV checks, etc.)?	[ ]	[√]

If not met, list affected samples and elements: _____

Additional Comments: _____

QC Review Signature: Johnetta Hester **Date:** 4-7-99

New Jersey • Fresh Ponds Corporate Village • Building B • 2235 Route 130 • Dayton NJ 08810 • tel 908 329 0200 • fax 908 329 3499 • http://www.accutest.com

METHOD BLANK AND SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

Analyte	Batch ID	RDL	MB Result	Units	BSP %Recov	QC Limits
Alkalinity, Total	GN22014	5.0	<5.0	mg/l	105.0	80-120%
Chlorine Demand	GN21988	0.50	<0.50	mg/l		
Nitrogen, Nitrate + Nitrite	GP6806	0.10	<0.10	mg/l	99.0	80-120%
Nitrogen, Nitrite	GN22018				99.3	80-120%
Nitrogen, Nitrite	GN22018	0.010	<0.010	mg/l	99.3	80-120%
Solids, Total Dissolved	GN22022	10	<10	mg/l		

Associated Samples:
Batch GN21988: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GN22014: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GN22018: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GN22022: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GP6806: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

MATRIX SPIKE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

Analyte	Batch ID	QC Sample	Units	Original Result	Spike Amount	MS Result	%Rec	QC Limits
Nitrogen, Nitrate + Nitrite	GP6806	E47322-1	mg/l	2.3	1	3.3	100.0	65-136%
Nitrogen, Nitrite	GN22018	E47323-1	mg/l	<0.010	.04	0.040	99.2	64-130%

Associated Samples:
Batch GN22018: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GP6806: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

DUPLICATE RESULTS SUMMARY
GENERAL CHEMISTRY

Login Number: E47323
Account: MENYNY - Metcalf & Eddy, Inc.
Project: MENYNY9975 - Mosholu G.C., Bronx, NY

Analyte	Batch ID	QC Sample	Units	Original Result	DUP Result	RPD	QC Limits
Alkalinity, Total	GN22014	E47323-1	mg/l	67.2	66.7	1.0	0-20%
Chlorine Demand	GN21988	E47290-2	mg/l	60.0	60.0	0.0	0-20%
Nitrogen, Nitrate + Nitrite	GP6806	E47322-1	mg/l	2.3	2.3	0.0	0-13%
Nitrogen, Nitrite	GN22018	E47323-1	mg/l	<0.010	<0.010	0.0	0-20%
Solids, Total Dissolved	GN22022	E47323-1	mg/l	149	152	2.0	0-11%
Solids, Total Dissolved	GN22022	E47405-1	mg/l	412	415	0.7	0-11%

Associated Samples:
Batch GN21988: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GN22014: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GN22018: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GN22022: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8
Batch GP6806: E47323-1, E47323-2, E47323-3, E47323-4, E47323-5, E47323-6, E47323-7, E47323-8

THIS PAGE INTENTIONALLY LEFT BLANK

SUBCONTRACT DATA

THIS PAGE INTENTIONALLY LEFT BLANK

RAdata, Inc.

27 Ironia Road, Unit 2
Flanders, NJ 07836
973-927-7303

April 01,1999

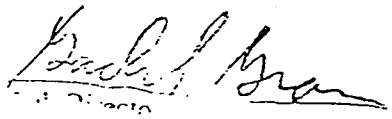
Accu Test
Patti
2235 Rt 130 South Bldg B
Dayton, NJ 08810

Radon Test Results/Information:

Name: Wackett, Harry
Test Location: Mosholu GC, Bronx NY

Test #	Test Date	Test Device	Location	Avg. Radon Concentration	Date Analyzed
61921-84692	3/25/99,10:00- 3/25/99,10:00	Water	Unknown Boring B5	207 pCi/L	3/31/99,18:06
61923-84694	3/25/99,14:00- 3/25/99,14:00	Water	Unknown Boring B50	<50 pCi/L	3/31/99,19:30
61927-84698	3/25/99,13:45- 3/25/99,13:45	Water	Unknown Boring B45	125 pCi/L	3/31/99,19:09
61929-84700	3/25/99,08.30- 3/25/99 08.30	Water	Unknown Boring B29	342 pCi/L	3/31/99,18:48
61930-84701	3/25/99,13:00- 3/25/99,13.00	Water	Unknown Boring B30	120 pCi/L	3/31/99,19:51
61931-84702	3/25/99,13.00- 3/25/99,13:00	Water	Unknown Boring B23	<50 pCi/L	3/31/99,20:33
61932-84703	3/25/99,09.30- 3/25/99,09 30	Water	Unknown Boring B17	130 pCi/L	3/31/99,18:27
61934-84705	3/25/99,14:15- 3/25/99,14 15	Water	Unknown Boring B36	295 pCi/L	3/31/99,20:12

If you followed the test instructions you can be confident that these results are accurate measures of the radon in water level at the time the test was taken. radon in water levels will fluctuate slightly over time WE ARE NOT RESPONSIBLE FOR INACCURACIES CAUSED BY THE IMPROPER USE OF THE VIALS, INCORRECT OR INCOMPLETED TEST INFORMATION, OR DAMAGE TO THE VIALS IN TRANSIT



THIS PAGE INTENTIONALLY LEFT BLANK

The Croton Water Treatment Plant

at Mosholu Golf Course, Van Cortlandt Park,

Borough of the Bronx, City of New York

Geotechnical Design Report

Volume 1
Report

City of New York
Department of Environmental Protection
Bureau of Environmental Engineering

November 2000

Metcalf & Eddy of New York, Inc. - Hazen and Sawyer, P.C.

A Joint Venture

The Geotechnical Design Report contains analysis and interpretations of the factual geological and geotechnical data gathered to support the design and construction of the Croton WTP Project. The information contained in this report is one interpretation of the data; other competent professionals may arrive at different interpretations. This report is provided for **information only** and should read in conjunction with the Geotechnical Data Report (GDR) to assist in understanding the considerations used to establish the design. The bidder is not relieved of its obligation to do any and all investigations and interpretations of data provided necessary for the development of its bid and performance of the Work, if awarded. The Engineer shall not be responsible for and shall not be liable to bidder for its reliance on Engineer's interpretation of such surface, geo-technical data. Moreover, the bidder shall have no cause of action against the Engineer arising out of or relating in any way to the interpretation hereby provided.

TABLE OF CONTENTS

Page

VOLUME 1 - REPORT

Section 1 - Introduction 1

1.1 Purpose of Study 1
1.2 Scope 1
1.3 Project Site 2
1.4 Available Historical Information 2
1.5 Facilities Layout 3
1.6 Foundation Design 4

Section 2 - Applicable Standards and Codes 5

2.1 Standards 5
2.2 Codes 5

Section 3 - Geological Conditions 6

3.1 General Geology 6
3.2 Seismicity 6
3.3 Existing Site Features and Topography 7

Section 4 - Subsurface Conditions 8

4.1 Site Stratigraphy 8
4.2 Soil and Rock Characteristics 9
4.2.1 Soil 9
4.2.2 Bedrock 9
4.3 Groundwater 19
4.4 Soil and Rock Permeability 19
4.4.1 Soil 19
4.4.2 Slug Tests 19
4.4.3 Rock 22
4.5 Selected Geotechnical Parameters for Soil and Bedrock 22

Section 5 - Geotechnical Analysis 25

5.1 Geotechnical Concerns 25
5.2 Groundwater Evaluation 25
5.2.1 Dewatering 25
5.2.2 Groundwater Quality 26
5.3 Soil Excavation 26

TABLE OF CONTENTS (continued)

Page

5.4 Bedrock Excavation and Blasting Characteristics of Rock 27
5.4.1 Rock Properties 27
5.5 Rock Wall Conditions 29
5.5.1 North Wall 29
5.5.2 East Wall 29
5.5.3 South Wall 29
5.5.4 West Wall 32
5.5.5 Scaling 32
5.6 Rock Wall Stability Analysis 32
5.7 Allowable Bearing Capacity of Foundations 35
5.7.1 Soil Foundations 35
5.7.2 Rock Foundations 35
5.8 Lateral Pressures for Foundation Walls 37
5.8.1 Hydrostatic Pressure 37
5.8.2 Static Soil and Rock Lateral Pressures 37
5.8.3 Seismic Soil and Rock Lateral Pressures 37
5.9 Permanent Soil Retention Systems 40

Section 6 - Recommended Foundations and Walls 41

6.1 Foundations 41
6.2 Walls 41
6.3 Dewatering System 42

Section 7 - Recommended Blasting Methods and Rock Reinforcement 43

7.1 Blasting Methods 43
7.1.1 Controlled Blasting 43
7.1.2 Presplitting 43
7.1.3 Cushion Blasting 44
7.1.4 Line Drilling 44
7.1.5 Smooth Wall Blasting 45
7.1.6 Main (Primary) Blasting For Open-Cut Excavation 45
7.2 Limitations on Ground Vibrations and Airblast 47
7.2.1 Ground Vibrations 47
7.2.2 Airblast 48
7.3 Blasting Specifications 49
7.4 Rock Bolting 51
7.5 Shotcrete 52

Section 8 - Site Work and Access Roads 53

8.1 Site Grading and Backfill 53
8.2 Roads and Parking Areas 53

TABLE OF CONTENTS (continued)

Page

Section 9 - Construction Considerations 55

9.1 Soil Excavation and Haul Roads 55
9.2 Rock Excavation and Temporary Rock Wall Reinforcement 55
9.3 Dewatering 56

Section 10 - Instrumentation and Monitoring 57

10.1 Geotechnical Instrumentation 57

TABLE OF CONTENTS (continued)

Page

LIST OF TABLES

Table

4-1 Foliation and Joint Set Orientation 15

4-2 Weighted Percentages of Rock Quality Designation (RQD) and New York City Building Code Rock Classes 16

4-3 Properties of Intact Rock 17

4-4 Slug Test Results for Well MG-B51-99 21

4-5 Estimated Range of Properties for Soil and Rock Materials and Recommended Values for Use in Design 24

5-6 Rock Stability Analysis 34

LIST OF FIGURES

Figure

4-1 Typical Gradation Ranges for Surficial Soils 10

4-2 Typical Gradation Ranges for Till and Saprolitic Soils 11

4-3 Standard Penetration Resistances (N-values) versus Depth Variation of Soil Consistency along the South Wall of the Excavation 12

4-4 Standard Penetration Resistances (N-values) versus Depth Variation of Soil Consistency along the South Wall of the Excavation 13

4-5 Unconfined Compressive Strength versus Elevation 18

4-6 Hydraulic Conductivity in Soil 20

4-7 Hydraulic Conductivity in Rock 23

5-1 Lateral Pressure Diagrams for Design of Foundation Walls 39

TABLE OF CONTENTS (continued)

VOLUME 2 - DRAWINGS

Sheet No. 1 Reference Plan for Subsurface Profiles

Sheet No. 2 Boring, Test Pit and Piezometers Reference Tables

Sheet No. 3 Subsurface Profiles, Section 1

Sheet No. 4 Subsurface Profiles, Section 2

Sheet No. 5 Subsurface Profiles, Section 3

Sheet No. 6 Subsurface Profiles, Section 4

Sheet No. 7 Subsurface Profiles, Section 5

Sheet No. 8 Subsurface Profiles, Section 6

Sheet No. 9 Subsurface Profiles, Section 7

Sheet No. 10 Subsurface Profiles, Section 8

Sheet No. 11 Subsurface Profiles, Section 9

Sheet No. 12 Contour Map of Bedrock Surface Elevations

Sheet No. 13 Contour Map of Groundwater Table for Bedrock, March 30, 1999

SECTION 1
INTRODUCTION

1.1 PURPOSE OF STUDY

This Geotechnical Design Report summarizes work performed by Metcalf & Eddy of New York, Inc. - Hazen and Sawyer, P.C., A Joint Venture, under contract to the New York City Department of Environmental Protection, Bureau of Environmental Engineering, for the proposed Croton Water Treatment Plant which will be located at the Mosholu Golf Course, Borough of the Bronx, City of New York, New York.

The geotechnical evaluations and recommendations outlined in this Report are based on the results of the geotechnical site investigation conducted by the Joint Venture between January and April 1999. The results of this investigation, including boring and test pit logs and associated in-situ and laboratory testing, have been incorporated into a separate two-volume document entitled "Geotechnical Data Report on the Subsurface Exploration for the Croton Water Treatment Plant, at Mosholu Golf Course, Van Cortlandt Park, Borough of the Bronx, City of New York," and dated November 2000.

1.2 SCOPE

Utilizing the specific subsurface information concerning the site, obtained from the subsurface investigation, it was possible to formulate criteria and recommendations regarding the geotechnical engineering aspects of the project. More specifically, the scope of the geotechnical services of this study includes the following tasks:

- Review of available geotechnical information on the site obtained through subsurface exploration
- Evaluation of in-situ conditions based on interpretive soil and rock profiles and characteristics, determination of bearing capacities, and potential seepage through soil and bedrock
- Development of criteria and recommendations regarding the geotechnical aspects of the project design and construction including
  - Foundation type, depths and design parameters for all structures and related works

- Groundwater design considerations
- Seismic considerations
- Site preparation and grading including soil and rock excavation, dewatering, foundation treatment, backfill, drainage requirements and collection systems
- Special problems such as soil slope stability, rock excavation by blasting, rock wall reinforcement, and retaining walls
- Monitoring of vibrations and noise during construction

- Design lateral earth and rock pressures for static and earthquake loading
- Construction considerations

1.3 PROJECT SITE

The Water Treatment Plant will be located beneath the area of the Driving Range of the Mosholu Golf Course, within the Van Cortlandt Park.

Access to the plant site during and after construction will be from Jerome Avenue near the northeast corner of the plant. Early in the construction phase, the entire project site will be fenced and concrete jersey barriers will be placed to demarcate the limits of construction. Laydown areas, off-street queue areas for trucks, and parking for construction workers' vehicles construction equipment and trailers will be located at the north and northeast sides of the plant over existing ground leveled with granular fill as required.

1.4 AVAILABLE HISTORICAL INFORMATION

The Mosholu Golf Course was established and created from parkland in 1914, and is currently leased to a private concessionaire. The present topography of the project site is partially the result of the alteration and shaping of the land in order to create the golf course. In 1989, the original 18-hole golf course was re-landscaped and opened as a 9-hole course with a practice driving range. No other information on the construction of the golf course is available with the NYC Department of Parks and Recreation and the Bronx Public Library. In the surrounding areas, construction activities included the opening of the Woodlawn Elevated Subway Station on Jerome Avenue in 1917 and the construction of Section No. 1 of City Tunnel No. 3 in 1980-1998. Design drawings for the Elevated Subway are available from the NYC Transit Authority (Route No. 16 - Section No. 2 Contract Drawings dated 1913 and Structural Plans dated 1914).

Construction records for City Tunnel No. 3 are available from the NYCDEP. The October 2000 Wastewater Quality Control Application Report prepared by the Joint Venture for the construction of the plant at the Mosholu Golf Course summarizes historical data including prehistoric background.

1.5 FACILITIES LAYOUT

The proposed Water Treatment Plant will be a large underground facility. The existing ground elevations throughout the proposed plant area, range from approximately Elevation 200 on the west to Elevation 170 on the east. The plant footprint will occupy an area of about 11 acres and will be below finished grade. The plant will include an operating floor level at Elevation 183, an access floor level at Elevation 168, and a foundation floor level at Elevation 130. Along the center and northern portion of the plant, there will be two Clearwells for a total capacity of 20 MGs. On the southern portion, there will be filters-to-waste tanks and waste backwash water tanks. A Raw Water Pumping Station, a Finished Water Pumping Station and a Backwater Pumping Station will occupy the west end of the plant, with Pump Room lower floors at various elevations with the deepest floor at Elevation 112 adjacent to the Raw Water and Finished Water Tunnels. These two tunnels will respectively house one raw water conduit, and two finished water conduits installed under the pump room floor slab at Elevation 112, in a pipe trench parallel to the west wall of the plant. The bottom of the trench will be at Elevation 96.5. In order to achieve the finished floor elevations, excavation through till and bedrock will be required. In the Pumping Station area, as much as 75 feet of excavation will be in rock, with an additional 14 feet of rock excavation in the pipe trench beneath the Pump Room floor slab.

The roof of the plant will be at Elevation 203 and covered with a 2-foot thick soil layer acting as a surface for the reconstructed Golf Course Driving Range. The Administration area will occupy the northeast corner of the plant. A new Club House for the Golf Course and a parking lot will be built as part of these facilities. The perimeter of the plant will show berms sloping in steps to match the existing ground elevations from Elevation 205 to Elevation 170 with retaining walls supporting the steepest portions. The plant will be accessed from Jerome Avenue via a new access road constructed along the alignment of the existing entrance road at about Elevation 170. The plant entrance and exit will be accessed through tunnel entrances in the north area. Road construction will require excavation in till and bedrock from ground Elevation 190 to the roads

final grade at Elevation 170±. The facilities layout will be continuously reviewed and developed throughout the final design phases of this project.

1.6 FOUNDATION DESIGN

The conceptual design has been further developed in a report entitled Technical Memorandum on Foundation Design dated May 1999. In this memorandum, several foundation alternatives for dealing with uplift forces and hydrostatic pressures on foundation walls were evaluated. The foundation options considered included rock anchors, concrete self-weight and an underdrained foundation. Based on technical merits, lower cost of construction and reasonableness of long-term operation and maintenance, an underdrain and pumping system was recommended to completely drain the groundwater surrounding the foundation.

SECTION 2
APPLICABLE STANDARDS AND CODES

The latest editions of Standards and Codes referenced below have been utilized for the preparation of this Report.

2.1 STANDARDS

AASHTO - American Association of State Highway and Transportation Officials

ACI - American Concrete Institute ACI 318 and 350

ASTM - American Society For Testing and Materials

NYCDEP Rules and Regulations Governing Concrete Construction

NYCDOT Standard Specifications

2.2 CODES

Building Code of the City of New York

New York City Seismic Code (Local Law No. 17-95)

UBC - Uniform Building Code

SECTION 3
GEOLOGICAL CONDITIONS

3.1 GENERAL GEOLOGY

The Borough of the Bronx is located in the Manhattan Prong Portion of the New England Upland Physiographic Province and underlain by tightly folded Pre-Cambrian metamorphic rock formations. The topography in this area is largely a product of pre-glacial stream erosion, modified somewhat by glacial erosion and deposition. It is mainly characterized by parallel, linear ridges and valleys having a northeasterly trend. The oldest formation is the Fordham Gneiss, a nearly-massive, banded metamorphic rock of complex composition and structure, which generally underlies the areas of high relief in the western portion of the Bronx where the Mosholu Golf Course is situated. The other formations in the Bronx are the Inwood Marble, which, in the western portion, underlies the low areas and the Manhattan Schist which underlies the eastern two-thirds of the borough. These latter two formations are not present at the project site.

Generally, the Fordham Gneiss Formation is exposed or is relatively close to the surface, overlain by Upper Pleistocene deposits. These deposits consist chiefly of glacial fluvial stratified sediments, largely outwash sand and gravel that have accumulated in depressions on the bedrock, locally including beds of reddish silt, as well as unstratified drift deposited as ground moraine (till) over the bedrock or stratified deposits of outwash. Weathering has locally affected the upper bedrock portion, forming a saprolitic horizon (decomposed rock) above the partly weathered or unweathered bedrock. Saprolite can be described as a dense, soil-like material grading from silts to sands, where relict rock structures are retained with less than 10 percent corestones, and is often micaceous. Since the till and saprolitic materials are often difficult to differentiate in samples recovered by subsurface drilling, they are normally considered as a single unit for design purposes.

3.2 SEISMICITY

The Eastern United States is an intraplate region with a moderate level of seismic activity. The probability of a major earthquake (intensity greater than VI) occurring in or near New York State

is small. However, historical earthquake records indicate that moderate epicentral earthquakes with Modified Mercalli Intensities (MMI) of VI (or a magnitude M of 5 on the Richter Scale) or less have occurred in several parts of the State, including New York City. Earthquakes of this magnitude could generate Peak Ground Accelerations (PGA) up to 0.15g. The 0.15g acceleration ($\partial_h\gamma$) is defined as the maximum horizontal ground acceleration for a 500-year return period earthquake. The New York Metropolitan area, being considered a low seismicity area, has been mapped into seismic risk Zone 2A by the 1988 Uniform Building Code (UBC). The New York City Building Code requires a Seismic Zone Factor Z of 0.15 and Site Coefficients of 0.67 for foundations bearing on bedrock and 1.0 for foundations bearing on glacial soil (medium dense to very dense glacial till).

3.3 EXISTING SITE FEATURES AND TOPOGRAPHY

The site slopes gently eastward approximately from Elevation 200 to Elevation 170. The Golf Course rests on firm soil substratum, which is, in general, moderately deep over bedrock. The topography of the general area appears to be bedrock-controlled. Large boulders are visible on the slopes along Jerome Avenue to the east and West Gun Hill Road to the south. The area surrounding the Driving Range is open space parkland with moderate vegetation and a wetland area adjacent to the northeast edge of the plant footprint. Another small wetland is located northwest of the proposed plant location. The original site topography, including areas adjacent to the Golf Course toward Jerome Avenue, has been previously modified through excavation and backfill for landscaping purposes and during construction of the Woodlawn Elevated Subway.

SECTION 4
SUBSURFACE CONDITIONS

4.1 SITE STRATIGRAPHY

In general, the subsurface conditions as determined from the subsurface exploration program at the plant site can be summarized as follows:

- Surficial Soils. These soils consist of 0 up to 34 feet of silty sand with occasional sandy silt and boulders, variable in color, with consistency varying, in general, from loose to medium dense (SM, SP-SM, 6-65 and 7-65 soil classes as per the New York City Building Code Numerical Classification System). In places they may also include organic matter and a few boulders in the upper 2 ft. (Class 11-65).

- Glacial Soil. A medium dense to very dense glacial till consisting of well-graded silty sand, gravel, cobbles, and boulders (SM and GM, SP-SM and GP-GM, Classes 6-65 and 6-65/5-65), generally underlies the surficial soils. The average till thickness is of the order of 10 feet. In places, imported fill or reworked till may overlay the till.

- Saprolitic Soil. Pockets of dense to very dense saprolite as thick as 10 feet are locally encountered above the partly weathered or unweathered bedrock.

- Bedrock. The overburden soils described above are underlain by bedrock from the Fordham Gneiss Formation, consisting of a foliated light-to-medium gray muscovite-biolite-plagioclase-quartz-gneiss locally transitioning to an amphibolitic or a quartz-banded gneiss, which is weathered and fractured at various degrees and depths. The depth to bedrock varies from 4 to 40 feet, averaging 15 feet. Typically, bedrock quality improves with depth, achieving Class 2-65 to 1-65.

The reference plan for subsurface profiles is presented on Sheet No. 1, and the subsurface profiles are presented on Sheet No. 2 through Sheet No. 11 in Volume 2 of this Report. The top of bedrock contours is presented on Sheet No. 12.

4.2 SOIL AND ROCK CHARACTERISTICS

4.2.1 Soil

A review of the field data indicates that most of the soils of glacial origin, including surficial soils, have a consistency varying from medium dense to dense, except for the upper 2 ft. which are generally loose and contain organic matter. The saprolitic soil from chemical weathering of gneissic bedrock is generally denser than the overlying till or silty sand layers. Figures 4-1 and 4-2 show typical gradation envelopes for 17 curves of surficial soils (SM, SP-SM, and 14 curves of till and saprolitic soils (SM and GM, SP-SM and GP-GM). The gradation analyses were performed on representative soil samples recovered from the Standard Penetration Tests (SPT) and presented in Volume 2 of the Geotechnical Data Report on the Subsurface Exploration, dated November 2000. Figures 4-3 and 4-4 show typical SPT profiles with N-values (Standard Penetration Resistance) plotted for the different soils in the vicinity of the south wall of the excavation, indicating the variation of the soil consistency with depth. It appears that there is a trend of increasing density with depth. Water content for these materials appears to be in the range of 7 to 12 percent, with some values as high as 37 percent.

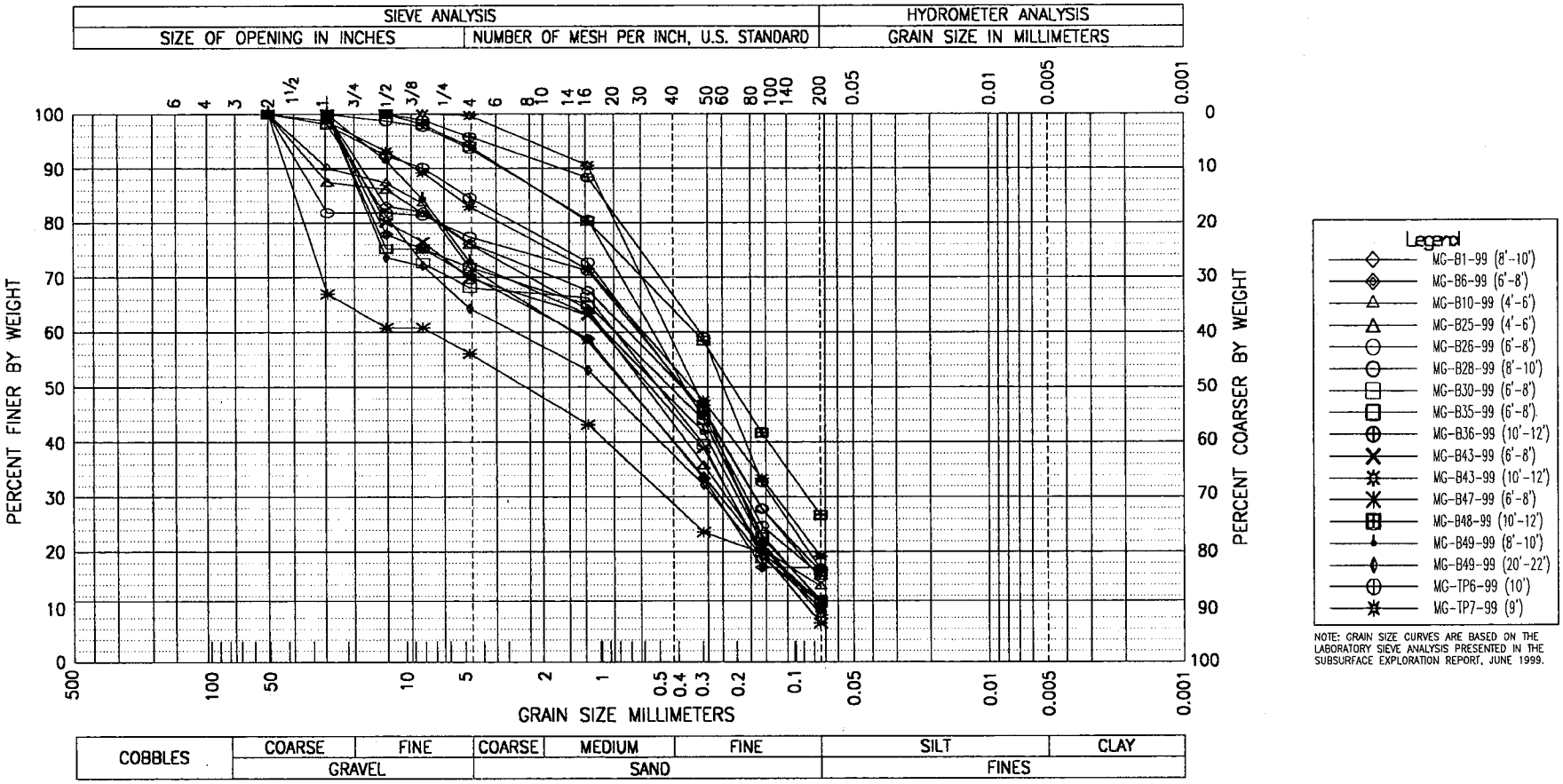
As previous construction activities may have also been undertaken at the site, it is possible that layers of fill or reworked till overlay the till or other natural soil. A sporadic occurrence of cobbles and boulders, generally small in size, has also been detected by the borings.

Both surficial material and glacial soils are not expected to be vulnerable to liquefaction during a seismic event.

4.2.2 Bedrock

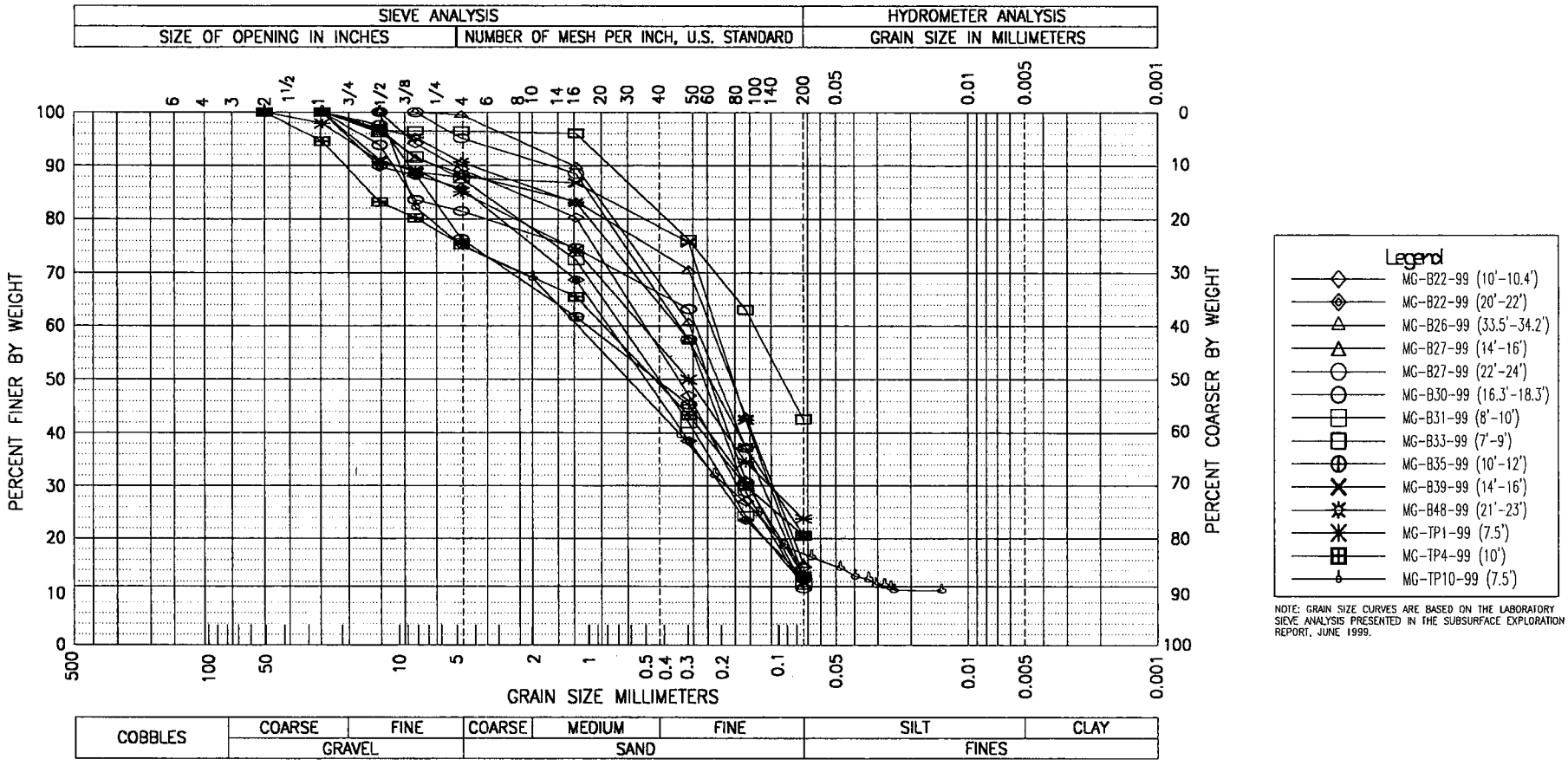
Bedrock can be classified as a foliated, light-to-medium gray gneiss transitional to a poorly foliated amphibolitic gneiss and quartz-banded gneiss. Foliation is generally inclined 50° to 80°. Foliation dip direction is variable and details are summarized in the Geotechnical Data Report.

Most of the shallow bedrock appears to be unweathered with localized areas of moderate-to-strong weathering near the surface. Unweathered to slightly weathered bedrock with occasional



NOTE: GRAIN SIZE CURVES ARE BASED ON THE LABORATORY SIEVE ANALYSIS PRESENTED IN THE SUBSURFACE EXPLORATION REPORT, JUNE 1999.

Figure 4-1
Typical Gradation Ranges For Surficial Soils
Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York



NOTE: GRAIN SIZE CURVES ARE BASED ON THE LABORATORY SIEVE ANALYSIS PRESENTED IN THE SUBSURFACE EXPLORATION REPORT, JUNE 1999.

Figure 4-2
Typical Gradation Ranges For Till and Saprolitic Soils
Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

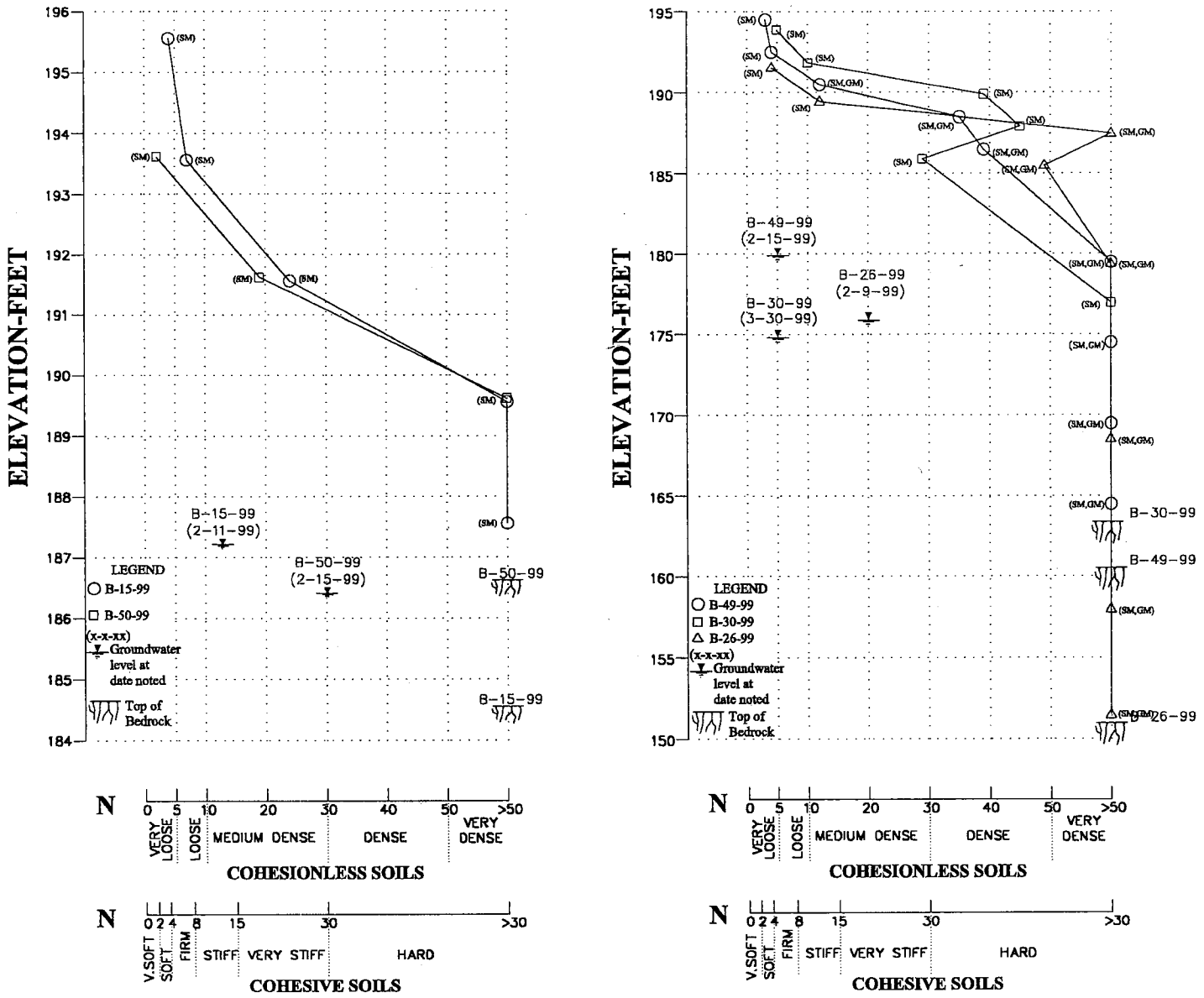


Figure 4-3
Standard Penetration Resistances (N-values) versus Depth
Variation of Soil Consistency along the South Wall of the Excavation
Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

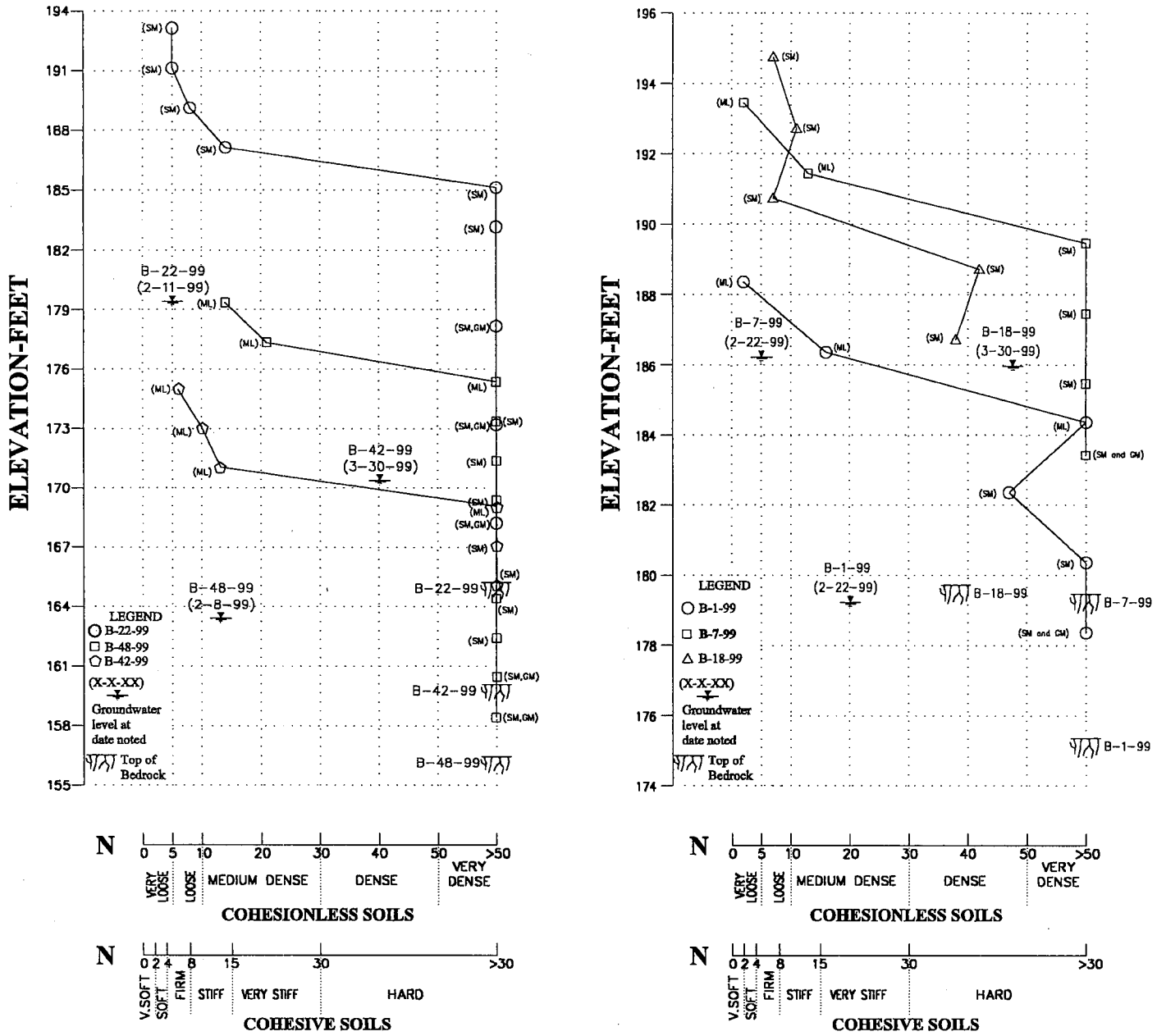


Figure 4-4

Standard Penetration Resistances (N-values) versus Depth

Variation of Soil Consistency along the South Wall of the Excavation

Croton Water Treatment Plant at Mosholu Golf Course

Van Cortlandt Park, Bronx, New York

lenses of moderate weathering has been encountered in the uppermost zone of the bedrock underlying the saprolite.

Oxidation on joints generally involves a deep portion of rock, averaging about 20 feet in thickness. In general, the rock has moderately close (12 inches to 3 feet) to wide spacing of joints (greater than 3 feet). Scattered zones of close jointing (2 to 12 inches) also exist, especially near the surface. Zones of highly fractured rock (less than 2-inch spacing) with smooth iron-stained and soil-coated joint surfaces are sporadic.

Joints along foliation (50° to 80°) and subhorizontal joints (5° to 30°) are predominant. Most of the foliation joints appear to be tight. Some openings may be related to close subhorizontal jointing and steep jointing across foliation. No major shearing or other important discontinuities, such as faults, have been detected by the boreholes. The foliation and the predominant joint set orientations in relation to the walls of the plant excavation are summarized in Table 4-1. These joint orientations have been measured on oriented cores as presented in Volume 2 of the Geotechnical Data Report on Subsurface Exploration.

A quantitative measure of rock quality available in the boring logs has been provided by the Rock Quality Designation (RQD) percentages. Rock cores have also been identified and classified in accordance with the New York City Building Code rock classification system. Rock cores, in general, vary from Classes 1-65 to 3-65, except for a few seams or relatively thin zones of rock classified as 3-65 to 4-65, indicating softer or more fractured material than a typical 3-65 Class. Rock Classes 1-65 and 2-65 are predominant. Table 4-2 presents the weighted averages of the New York City Building Code rock classes and RQDs encountered throughout the plant area at foundation level. The RQD values indicate generally good rock conditions.

Mechanical properties investigated in the laboratory include Unconfined Compressive Strength (UCS), tensile strength, Young's modulus and Poisson's ratio to provide data for classification and correlation. Table 4-3 lists the range of results obtained form the various tests on intact rock. The average UCS obtained from 48 laboratory tests is about 9,800 psi, and the distribution is shown on Figure 4-5. A Moh's Hardness Rating of 7 can be assumed for these rocks, indicating hard rock.

Table 4-1

Foliation and Joint Set Orientation

(From Oriented Core Measurements)

Croton Water Treatment Plant at Mosholu Golf Course

Van Cortlandt Park, Bronx, New York

Excavation Wall	Foliation/Joint Set	Strike	Dip	Comment
North	Foliation	N to N20°W	40° to 65°E	Generally Variable
North		N 60°W	30° to 80°N	
North		N to N 40°W	40° to 60°W	
North		N 20°E	50° to 60°W	
East		N 60°W	60°N to 90°	
East		N 80°W	70°S to 90°	
South		N 30° to 40°W	60° to 70°N	
South		N 60° to 80°W	30° to 80°S	
South		N 40° to 80°W	50° to 75°N	
West		N 28° to 38°E	70° to 85°N	
West		N 50° to 58°E	30° to 80°N	
West		N 65°W	60° to 70°S	
North	Foliation Joint	N 50° to 60°W	10° to 50°N	Predominant
North		N 5° to 20°W	60°W	
East		N 50° to 80°W	60° to 70°N	Predominant
East		N 60°W	60° to 70°S	
South		N 30° to 80°W	70° to 85°N	Predominant
South		N 30° to 40°W	40° to 50°S	
Wet		N 28°E	70° to 80°N	
North	Joints Across Foliation	N 80°E	60°	Less Numerous
North		N 10°E	70°	than Foliation
East		N 80°W	55°S	Joints
South		N 5° to 10°E	40° to 80°N	
West		N 52° to 60°E	60°N	
West		N 60°W	20°S	
North	Joints with Foliation Trend	N to N 10°W	40° to 50°S	
East		N 60°W	30°S	
South		N 70°W	30°S	
West		N 78°E	60°N	Predominant
West		N 68°E	20°S	
West		N 60°W	20°S	
North	Subhorizontal Joints	N 20° to 80°W	20° to 30°S	Predominant
North		N 40°E	30°N	
North		N	10° to 30°E	
South		N 70°W	20°N	
West		N 68° to 88°E	10° to 30°N	Predominant
West		N 60° to 85°W	5° to 30°N	
West		N 25°W	20°N	
West		N 5°E	20°N	

Table 4-2

Weighted Percentages of Rock Quality Designation (RQD) and New York City Building Code Rock Classes

Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

Weighted Percentages of Rock Quality Designation (RQD)

		Bedrock Elevation<165 FT		All Rock Areas (From Top of Bedrock)	
RQD %	RQD Quality	Total Percentage, %	Cumulative Percent, %	Total Percentage, %	Cumulative Percent, %
90 - 100	Excellent	54.1	54.1	49.7	49.7
75 - 90	Good	23.5	77.6	25.1	74.8
50 - 75	Fair	16.6	94.2	17.7	92.5
25 - 50	Poor	5.2	99.4	6.8	99.3
< 25	Very Poor	0.6	100	0.7	100

Weighted Percentages of Rock Classes (NYC Building Code Classification)

		Bedrock Elevation<165 FT		All Rock Areas (From Top of Bedrock)	
NYC Rock Classes	Bearing Capacity (KSF)	Total Percentage, %	Cumulative Percent, %	Total Percentage, %	Cumulative Percent, %
1-65	120	60.5	60.5	56.9	56.9
2-65	80	28.6	89.1	30.5	87.4
3-65	40	9.3	98.4	10.5	97.9
3-65/4-65	20	1.6	100	2.1	100

Table 4-3
Properties of Intact Rock

Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

Compressive Strength for Main Rock Types

Description	Gneiss	Quartz Banded Gneiss	Amphibolitic Gneiss	All Rock Types
Average Strength (psi)	7,808	12,587	7,929	9,804
Maximum Strength (psi)	20,257	19,678	8,457	20,257
Minimum Strength (psi)	3,564	2,605	7,400	2,605
Standard Deviation	3,326	3,979	747	4,236
25th Percentile	5,642	9,960	7,664	7,383
Average Predominant Strength (Middle 60% of Results)	7,676	12,598		9,374
Number of Tests	26	20	2	48

Comparison of Mean Compressive and Tensile Strengths for Main Rock Types

Rock Type	Number of Tests		Compressive Strength (psi)	Tensile Strength (psi)	Percent of Tensile:Comp (%)
	Comp.	Tensile			
Gneiss	8	8	7,529	695	9.23
Quartz Banded Gneiss	8	8	13,745	788	5.73
Amphibolitic Gneiss	1	1	7,400	760	10.27
All Rock Types	17	17	10,477	742	7.08

Mean Static Young's Modulus and Poisson's Ratio

Rock Type	Number of Tests	Young's Modulus (ksi)	Poisson's Ratio
Gneiss	6	450	0.21
Quartz Banded Gneiss	4	639	0.24
Amphibolitic Gneiss	1	306	0.28
All Rock Types	11	506	0.23

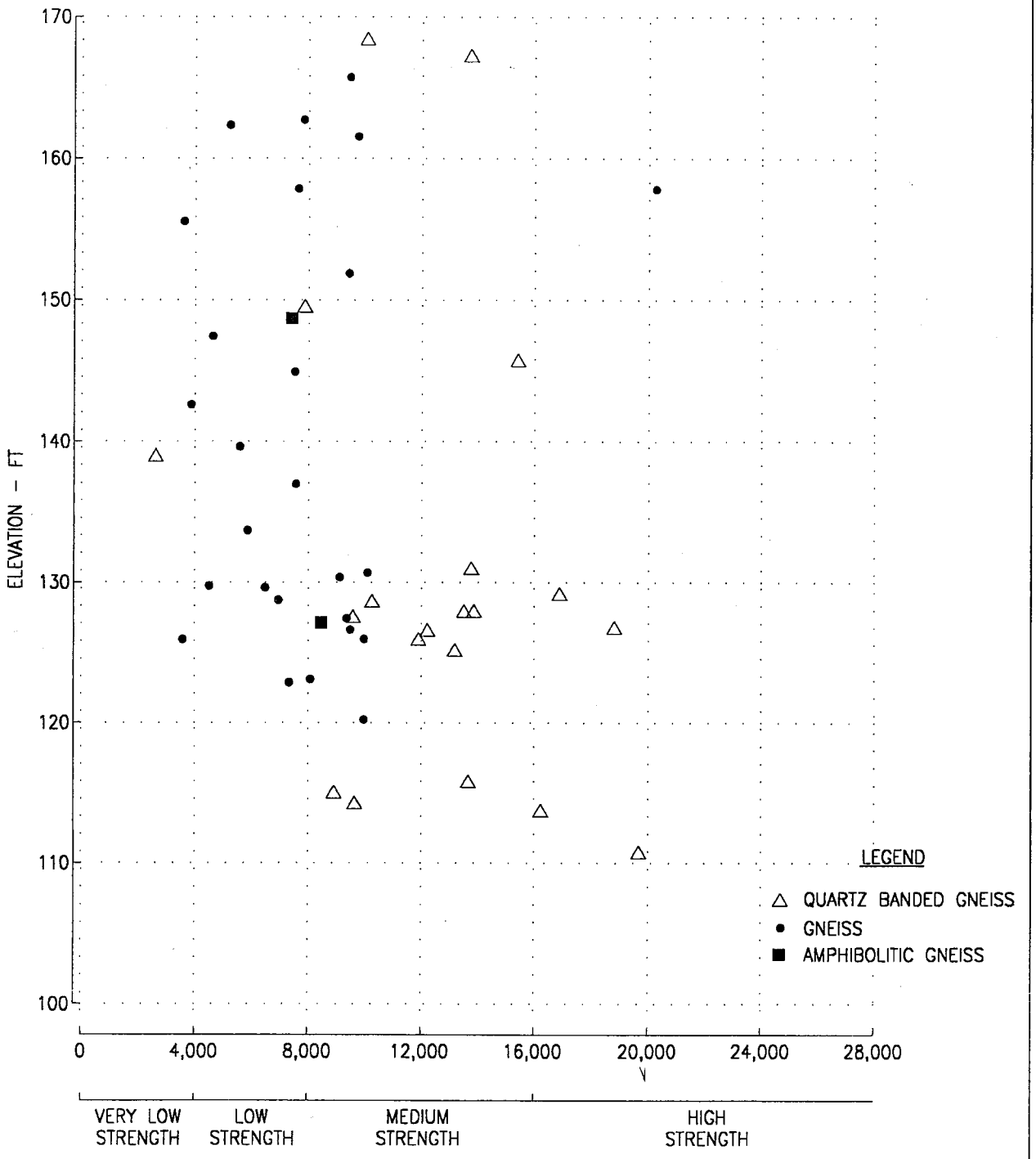


Figure 4-5
Unconfined Compressive Strength Versus Elevation
Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

Tensile strength values obtained from testing are approximately 5 to 10 percent of compressive strength. The presence of oriented features such as foliation and lamination within the intact specimen generally tends to lower the tensile strength as it does for the compressive strength.

Mean values of Poisson's ratio shown on Table 4-3 appears to be typical of gneissic and quartzitic rocks within the elastic domain, for which Poisson's Ratio is generally of the order of 0.15 to 0.30.

4.3 GROUNDWATER

The water table varies between Elevations 186 and 165, dropping from the southwest to the northeast in general. The isolated wetland pockets are perched above the regional groundwater table. Groundwater contours from water level readings of piezometers installed in bedrock are presented in Sheet No. 13 in Volume 2 of this Report.

4.4 SOIL AND ROCK PERMEABILITY

4.4.1 Soil

Coefficients of hydraulic conductivity (K-values) from falling head borehole permeability testing in soil, vary from no absorption to 4.4×10^{-3} cm/sec with most of the values in the 10^{-4} to 10^{-5} cm/sec range, indicating generally poor drainage characteristics. Plot of K-values by elevation is presented on Figure 4-6. The various permeabilities reflect the distribution of the soil types in both horizontal and vertical direction.

4.4.2 Slug Tests

Slug tests conducted in the overburden soils near the existing northeast wetland, yielded permeability values of 1.3×10^{-4} to 1.9×10^{-4} cm/sec, indicating a soil with poor drainage characteristics. Slug test results are summarized on Table 4-4.

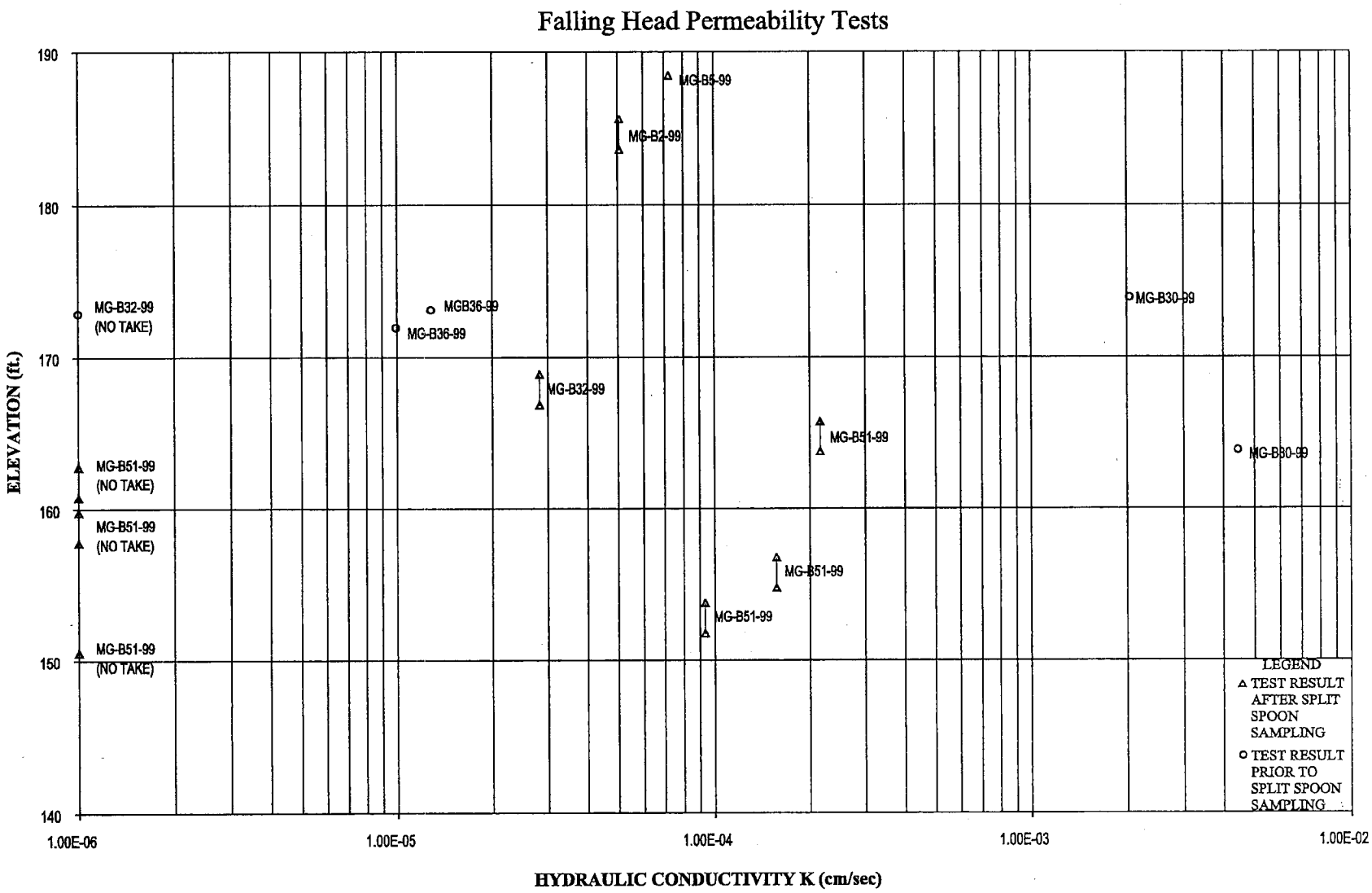


Figure 4-6
Hydraulic Conductivity in Soil

Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

Table 4-4

Slug Test Results for Well MG-B51-99

Croton Water Treatment Plant at Mosholu Golf Course

Van Cortlandt Park, Bronx, New York

Test	Hvorslev Slug Test Analysis (ft./day)	Bouwer Slug Test Analysis (ft./day)
Falling Head No.1	0.466	0.450
Rising Head No. 1	0.337	0.376
Falling Head No.2	0.530	0.555
Rising Head No. 2	0.361	0.442
Falling Head No.3	0.517	0.484
Rising Head No. 3	0.394	0.465
Average Falling Head Test Result	0.504	0.496
Average Rising Head Test Result	0.364	0.428
Average Rising & Falling Head Results	0.434	0.462
Average of All Test Results, Both Methods	0.448	

4.4.3 Rock

Permeability tests performed by packer testing in the rock yielded hydraulic conductivity results from no absorption to 9.56×10^{-3} cm/sec. However, the majority of the values are in the range of 10^{-4} to 10^{-5} cm/sec, indicating that the rock formation is semi-impervious with poor drainage characteristics. Low permeability for a rock mass is considered to be 1.0×10^{-6} cm/sec or lower. The hydraulic conductivity values in bedrock are presented on Figure 4-7.

4.5 SELECTED GEOTECHNICAL PARAMETERS FOR SOIL AND BEDROCK

Table 4-5 gives the range of material properties and the recommended values for use in design. Values shown for the soils are mainly based on correlation with N-values. The other values are assumed to be within typical ranges. Values recommended for rock are essentially based on laboratory testing for Modulus of Elasticity and Poisson's Ratio. The recommended value of the Modulus of Elasticity (500 KSI) is based on an average RQD value of 80 percent.

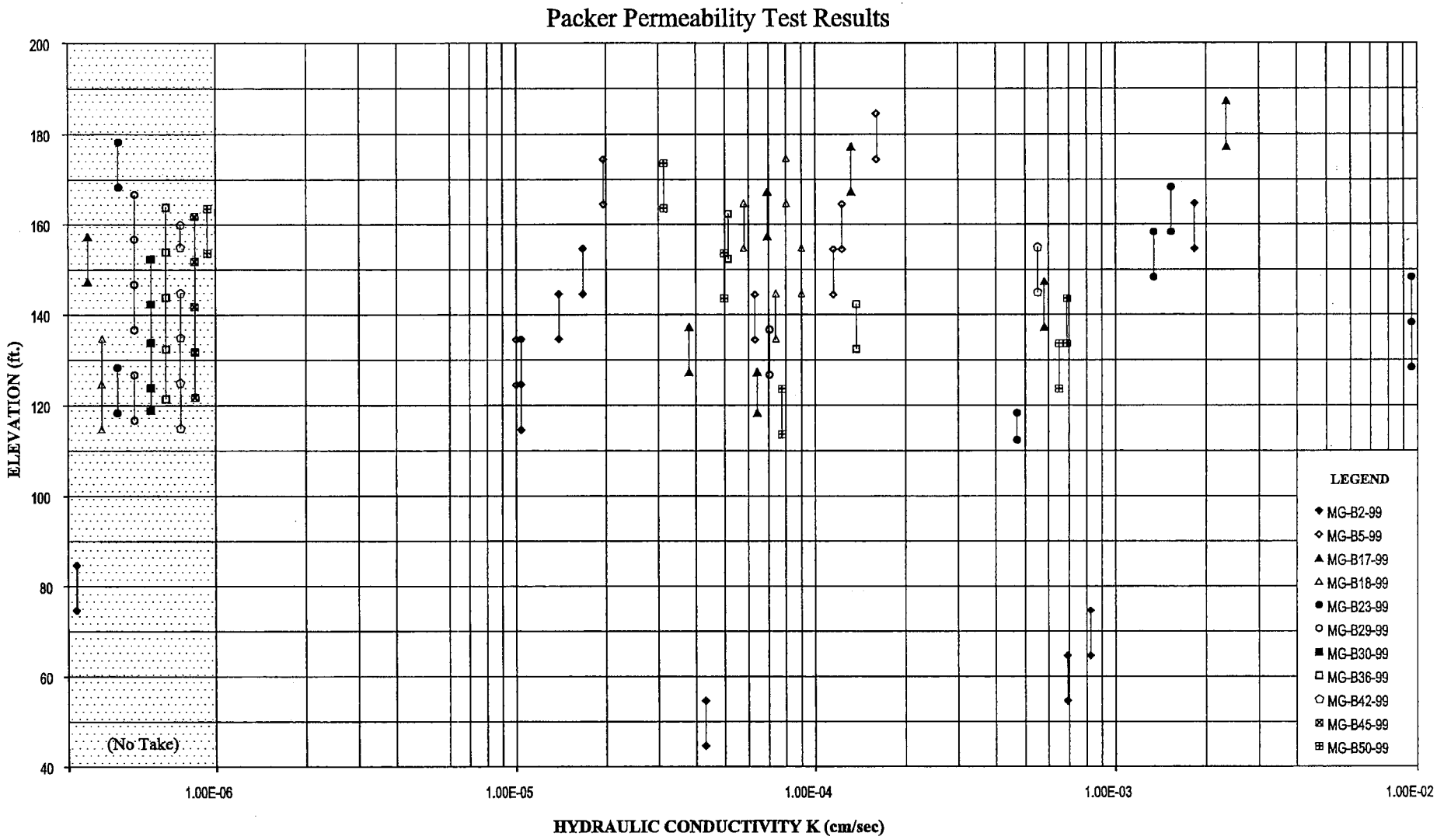


Figure 4-7
Hydraulic Conductivity in Rock

Croton Water Treatment Plant at Mosholu Golf Course.
Van Cortlandt Park, Bronx, New York

Table 4-5
Estimated Range of Properties for Soil and Rock Materials and Recommended Values for Use in Design

Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

Material	Unit Weight, PCF		Angle of Internal Friction, Degrees	Coefficient of At-Rest Earth Pressure	Modulus of Vertical Subgrade Reaction,Moist, KCF	Unconfined Compressive Strength, PSI	Modulus of Elasticity, KSI	Poisson's Ratio	Allowable Bearing Pressure, KSF	Recommended Coefficient of Friction	
	Moist	Saturated								Formed Concrete	Mass Concrete
NATURAL SOIL											
Silty Fine to Medium Sand, Loose to Medium Dense; SM and SP-SM	90 - 130*	115 - 135*					1.0 - 3.0				
	Recommended Value		Recomm. Value	Recomm. Value	Recomm. Value		Recomm. Value	Recomm. Value	Recomm. Value	0.35	0.40
	125	130	30	0.50	300		2	0.30	4		
Silty Sand and Gravel Mixture, with Cobbles and Boulders (Till and Saprolite), Medium Dense to Very Dense; SM and GM; SP-SM and GP-GM	120 - 145*	130 - 150*					7 - 20				
	Recommended Value		Recomm. Value	Recomm. Value	Recomm. Value		Recomm. Value	Recomm. Value	Recomm. Value	0.45	0.5
	130	140	35	0.43	550		14	0.35	10		
STRUCTURAL BACKFILL											
Crushed stone or Compacted Granular with < 5% passing the No. 200 Sieve											
	Recommended Value		Recomm. Value	Recomm. Value	Recomm. Value		Recomm. Value	Recomm. Value	Recomm. Value	0.45	0.55
	130	140	36	0.41	600		16	0.35	12		
SELECT COMMON FILL											
Compacted Granular with < 15% passing the No. 200 Sieve											
	Recommended Value		Recomm. Value	Recomm. Value	Recomm. Value		Recomm. Value	Recomm. Value	Recomm. Value	0.40	0.45
	125	135	34	0.44	500		14	0.30	10		
ROCK											
FORDHAM GNEISS FORMATION											
	Recommended Value		Recomm. Value			Recomm. Value	Recomm. Value	Recomm. Value	Recomm. Value		0.65
	168		30 on joints			9800*	500	0.23*	80		

*Value ranges based on laboratory results

SECTION 5
GEOTECHNICAL ANALYSIS

5.1 GEOTECHNICAL CONCERNS

The geotechnical concerns on this project are listed below:

- Groundwater control
- Stability of excavated slopes in soil and rock, particularly the rock walls
- Restrictions on excessive vibrations, noise or flying debris from blasting operations

5.2 GROUNDWATER EVALUATION

5.2.1 Dewatering

The estimated rate of groundwater inflow is approximately 110 gpm, based on linear footage of excavation using packer test data and typical flow rates for this area. This rate is considered to be the steady state ground water in flow and used to design the underdrain system. It is not to be confused with the temporary dewatering of the excavation during construction which may be substantially higher. During construction, the excavation will be dewatered to maintain the groundwater level below the lowest point of rock excavation in the areas required to progress the work. The current design concept for the proposed Water Treatment Plant calls for control of buoyant uplift forces by permanently lowering groundwater levels beneath and adjacent to the structure. This will be attained by placing an underdrain system below the foundation slab and pumping the water to the existing Combined Sewer on Jerome Avenue. Dewatering during construction will likely be accomplished by pumping from sumps. Stormflows into the excavation would be the major source of water to be vacated during construction. Grouting of the more significant water-producing fractures in the bedrock, if any exist, will be done to reduce the inflow of groundwater.

The Stormwater/Groundwater Plan Memorandum, dated June 11, 1999, describes the drainage system for plant dewatering. The plant would have drainage at three levels: a roof drainage system collecting stormwater; an intermediate drainage system at the top of the bedrock surface between Elevations 160 and 180 to drain ground water from the soil; and a lower underdrain

system below the base slab. The roof water will be drained by gravity to the Combined Sewer on Jerome Avenue. Water from the intermediate level would be conveyed partly to the Combined Sewer and partly to infiltration trench system north of the plant. The water collected by the underdrain pipes would be pumped to the Combined Sewer.

5.2.2 Groundwater Quality

In order to characterize the quality of groundwater that would enter the underdrain system from the deep bedrock, water samples were collected from several of the piezometers for screening purposes and analyzed for alkalinity, total dissolved solids, iron, manganese, pH, and Radon. Sampling analyses indicate quality typical of groundwaters, with elevated alkalinity, turbidity, hardness and solids. Groundwater analysis results can be found in the Dewatering Approval/Wastewater Quality Control Application, dated November 1, 2000.

Preliminary groundwater sampling has detected Radon concentrations in groundwater ranging from less than 50 to 342 pCi/l. There are no current standards available for Radon in groundwater. The EPA standard for Radon in air is 4 pCi/L with a ratio of 10,000 to 1 for Radon in water to air for a confined space. Therefore, the threshold value which could result in exceedence of the limit in confined air space over water is 40,000 pCi/l. The range of concentration so far detected at the Mosholu Golf Course site is over 100 times less than the 40,000 pCi/l limit. Radon, therefore, is not a concern for construction activities or subsequent operation of the WTP at the site. However continued testing for Radon in groundwater and air should be performed periodically during construction.

5.3 SOIL EXCAVATION

The overburden soils at the site can be excavated with standard earth moving equipment. The long-term excavation slopes can be as steep as 1 vertical to 1.5 horizontal in dense soil to provide for adequate stability. Compaction and seeding of the slopes will be required. For steeper slopes, in situ reinforcement of the soil, either a geosynthetic soil reinforcement, soil nailing or other mechanical stabilizers or an earth retention wall will be required, and the design of such reinforcement shall be performed by a New York State registered Professional Engineer hired by the Contractor.

5.4 BEDROCK EXCAVATION AND BLASTING CHARACTERISTICS OF ROCK

Bedrock excavation will be performed by using controlled blasting techniques to control overbreak at the excavation lines and bench blasting for the production blasting (main blast) to remove the rock mass from inside the main excavation pit. Overbreak control methods are presplitting, cushion blasting and line drilling, which will be described later in this Report. Tunnel excavation will be performed using smooth wall blasting technique, which is a form of controlled blasting. Decisions on explosive selection, blast design and delay pattern must take the knowledge of the rock mass into account. For instance, the geological variations and the manner in which the beds and joints are dipping either influence the amount of explosive used or influence the design of the burden.

5.4.1 Rock Properties

Important rock properties related to the fragmentation process are rock density, hardness, strength and seismic velocity. The rock density is an indication of the rock strength, the denser the rock, the more energy needed to overcome its tensile strength for breakage to occur. For the rock types encountered at the site, a density of 2.7 g/cm^3, a rock factor of 8 for rock strength (Kuznetsov, 1973) and a field seismic velocity (longitudinal wave velocity) of 14,000 fps may be assumed for blasting design in medium hard gneissic rock. The hardness can have a strong effect on blasting results. Slight underblasting of medium-hard to hard rock will often result in a tight muckpile difficult to dig; overblasting of hard rock is known to cause excessive flyrock and airblast.

The seismic velocity, or the velocity with which stress waves propagate in the rock, is related to the distribution of the stress imposed on the rock by the detonating explosives and is used to calculate the impedance characteristics of the rock for selection of the best explosive. It is said that the higher the rock velocity, the higher the explosive required to break it. Explosives with impedance nearly matching that of the rock, transfer energy to the rock more efficiently. Based on the above seismic velocity value, the characteristic impedance for the gneiss at the site would be approximately 42 lb/sec/in^3. The impedance of an explosive is related to its detonation velocity. Characteristic impedance is only one of the criteria needed for the selection of the explosive. Other factors are rock structure, presence of water, safety and cost.

The structural pattern of the rock exerts a major influence on fragmentation. Corrections for the geologic structure and rock bedding or schistosity should be used in the design of the burden (distance from blasthole to nearest free face at the instant of detonation). The burden should be corrected for number of rows of blastholes and for geologic structure. The correction for the geologic structure would take into account the fracturing of the rock, the joint strength and frequency at the site. A Correction Factor of 1.10 may be used for blocky to massive rock with tight joints, and as a Correction Factor of 1.18 for bedding or foliation steeply dipping into the excavation. The Correction Factor for number of rows is usually 1 for one or two rows of holes and 0.90 for more than two rows. The above Correction Factors appear to be typical of the project site conditions.

Another factor can be the presence of a blocky cap rock at the upper part of the blasthole. This can particularly occur in the top bench (lift) nearest to the weathered zone of the rock mass. The weathered zone at the site varies in thickness from 4 to 9 feet, and can be assumed, for blasting purposes, as a layer parallel to the ground surface. Velocities in more fractured and weathered zones are less than those in the underlying fresh rock. Consequently, blasting techniques should be adjusted. However, as the rock at the site is generally moderately weathered below the top of rock contours as shown in the contour map of bedrock (Volume 2) and the zone of weathering rather small, a method would be to use the same explosive but to slightly decrease the powder factor in the weathered zone. If voids and zone of weakness (open joints, fractured areas) are identified during the drilling of blastholes, steps can be taken during the blasthole loading to improve fragmentation and avoid flyrock. Voids and zones of weakness should be filled with inert stemming materials (drilling cuttings or well-graded crushed stone or gravel) between charges (decking) to give confinement to the explosive gases and to reduce flyrock and airblast. It is recommended that a test blast program prior to the commencement of actual blasting operations be performed by the Contractor for the design of both controlled blasting and production blasting.

Zones saturated by groundwater require explosives with greater water resistances and necessitate more care in stemming.

5.5 ROCK WALL CONDITIONS

The effect of local geologic conditions, such as foliation and jointing, on the profile and stability of the perimeter walls of the excavation, based on of the orientation and description of various joint sets, can be summarized as follows:

5.5.1 North Wall

The strike of the predominant joint sets (foliation joints and subhorizontal joints) will intersect the wall face at an acute angle generally greater than 30°. Consequently, the break line produced by the control technique will be reasonably straight.

If joints are weak, e.g., smooth, weathered joints, backbreak will result. It is expected that moderate backbreak due to weathering and jointing will occur within the upper 7 feet of the wall. In addition, acute angled dipping joints (subhorizontal joints and joints across foliation) will cause pieces of material to fall out from the face during the excavation process in some areas. However, on the whole, the face will be stable and only local reinforcement will be required in the form of rock bolts and shotcrete.

5.5.2 East Wall

In relation to wall profile, the considerations to be made for the east wall are the same as those for the north wall. The face will be generally stable, as it appears that there are only a few joint sets dipping steeply outward from the excavation wall. Some backbreak is expected to occur in the upper 4 feet of the wall. Only local reinforcement will be required in the form of rock bolts and shotcrete.

5.5.3 South Wall

Steep foliation joints appear to be predominant and some slippage is expected to occur along foliation planes during blasting. The wall profile, due to the joint orientation, will be generally rough. Unstable wedges may form due to the combination of foliation joints and steep joints across foliation dipping outward from the wall. Moderate backbreak is expected to occur within

the upper 7 feet of the wall. Rock reinforcement will be required in the form of rock bolts, wire mesh and shotcrete.

5.5.4 West Wall

The dominant joint sets appear to dip into the excavation wall; thus, the stability of the wall is enhanced. As per the boring log description, the west wall has the thickest weathered and fractured upper zone, approximately 9 feet, where some backbreak may occur. However, on the whole, the face will be stable and only local reinforcement will be required in the form of rock bolts and shotcrete.

5.5.5 Scaling

Scaling should be completed after blasting each bench and before excavating deeper. Each wall will be inspected to remove any remaining loose rock, installing rock bolts and other stabilizing measures, such as shotcrete, as needed. The work has to be completed while access remains available; it will be too late to recognize unstable wedges or incompetent, loose, blocks after they are undercut and dangerous to stabilize. The installation of the rock bolts and shotcrete should be organized in such a way that the installation becomes an integral part of the excavation cycle.

Access to low and intermediate-height slopes is possible with suspended power platforms or hydraulic boom cranes. Workers on ropes usually carry out scaling on the upper reaches of high faces. Useful scaling tools include hand pry bars, bencher drills, jackhammer, air operated scaling tools, hydraulic splitters or jacks.

5.6 ROCK WALL STABILITY ANALYSIS

An evaluation of rock slope stability was performed for the excavation faces of the Croton Water Treatment Plant utilizing SWARS. The SWARS program was developed by Dr. Herbert Einstein of Massachusetts Institute of Technology and is distributed by GEOCOMP Corporation. The program allows for the input of numerous joint sets and evaluates the wedges that could develop along an excavation face. Both 2-plane and 3-plane wedges that are developed along each excavation face are analyzed.

The orientation of the predominant joint sets was determined from the oriented core data. The strike and dip of the joint sets used in rock stability analysis are:

N60°W	58°NE
N78°W	66°NE
N62°W	60°SW
N90°E	15°N
N28°E	72°NW

The following assumptions were used regarding the characteristics of the joints:

- Friction angle of 30°
- Faces are planar and smooth (i.e., no asperities)
- Joint plane faces are in contact
- Ten percent of the joint planes are intact rock, with a shear strength of half of the average unconfined compressive strength of 7,800 psi for Gneiss
- Due to the rate of excavation and the dewatering of the site, groundwater pressures are not a factor
- The unit weight of the rock is 168 pcf
- Overburden (125 pcf) and equipment surcharges are imposed on the wedges depending upon the case studied.

The height of the excavation faces is dependent upon the top of rock and the excavation levels for the structures. The bottom of the excavation for this analysis was assumed to be at Elevation 125. The top of the excavation faces was determined from the top of rock map developed for the site. The information on the excavation faces was taken from the conceptual design drawings. The excavation faces analyzed are as follows:

Face	Orientation	Total Height of Rock Face (ft.)	Length (ft.)
North Face	N82°W/85°SW	60	970
East Face	N08°E/85°NW	35	450
South Face	N82°W/85°NE	60	970
West Face	N08°E/85°SE	60	450

The stability analysis was performed for both construction conditions and final conditions. Construction conditions were modeled by introducing a uniform vertical pressure of 300 psf on the top of the slope to represent equipment surcharge. Final conditions were modeled in the same fashion, but the uniform vertical pressure was approximately 3,850 psf for the 50-foot rock excavation faces and 5,300 psf for the 35-foot rock excavation faces. The uniform vertical pressure in the final case is representative of soil overburden. The analysis indicated that the loading from the final conditions was the more critical case.

Based on the assumptions listed earlier, the north, east and west faces are stable without requiring any systematic pattern of permanent rock reinforcement. However, the south face has unstable wedges that will require a stabilization system. Table 5-6 summarizes the data pertaining to possible unstable wedges and the required permanent stabilization system by rock bolting.

A sensitivity analysis was undertaken to determine the critical characteristics of the potential wedges that developed on the south face. The coefficient of friction, asperities, and the percentage of the joint that was intact rock were systematically analyzed to determine whether the south wall could be stabilized using realistic values based on the information currently available. The analysis indicated that the factors of safety for the two critical cases shown on Table 5-6 did not change significantly with changes that could realistically be expected in friction angle, asperities, or percentage of intact rock along the potential joints. The two critical cases could not be stabilized without the use of rock bolts. To stabilize these wedges, a horizontal force of 35,000 Kips was entered into the program to achieve a minimum Factor of Safety of approximately 1.2.

The larger size of the wedges in the south wall apparently are not sensitive to moderate changes in the percentages of intact rock along the foliation and joint planes, i.e., reduction from 10 percent intact rock to 0 percent indicate little, if any, changes in factor of safety. However, smaller wedges such as those developed on the North and East walls are sensitive and become unstable when the percentage of intact rock is reduced from 10 percent to 0 percent.

In summary, the South wall indicates instability in either case; however, there also may be a potential for some instability in the North and East walls depending on the amount of intact rock along the joint planes.

The Contract Documents will show a sequence of construction that removes the overburden in a 40 foot maximum wide band around the perimeter of the excavation (working platform) prior to rock excavation. At that time, the condition of the joints will be reevaluated and permanent rock reinforcement designed where required to prevent any lateral rock pressures on the walls of the structure.

Table 5-6
Rock Stability Analysis

Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlant Park, Bronx, New York

Joint Sets		Volume of Wedge (Cu.Ft.)	Area of Wedge on Excavation Face (Sq. Ft.)	Factor of Safety without Stabilizing Force	Horizontal Force Required to Stabilize the Wedge (Kips)	Factor of Safety with Stabilizing Force	Rock Bolt Spacing (Ft.)	Number of Rock Bolts on Face of Wedge	Rock Bolt length (Ft.)	Load on Bolts (Kips)
South Face										
2	3	123151	17040	0.52	35000	1.27	5 x 5	681	30-10	51.4
2	5	73539	17040	0.34	35000	1.29	5 x 5	681	30-10	51.4

Joint Set Numbers for the South Faces:

1	N90E/15N
2	N28E/72NW
3	N60W/58NE
4	N62W/60SW
5	N78W/66NE

5.7 ALLOWABLE BEARING CAPACITY OF FOUNDATIONS

5.7.1 Soil Foundations

Soil foundations for structures outside the Water Treatment Plant may be constructed on dense till or saprolitic soil. The design allowable bearing pressure on till and saprolitic soil can be assumed to be 10 ksf as an alternative to the conventional rigid approach. A modulus of vertical subgrade reaction of 550 kcf may be used for designing a mat foundation above the water table. Half of this value can be used for a mat below water table with no drainage. The base slab should be built on a 10-inch thick (before compaction) clean crushed rock layer (ASTM D488, Size Number 67) placed on the soil subgrade as a leveling course and drainage layer. The crushed rock layer shall be underlain with a geotextile. Shallow foundations supported on soils shall be embedded a minimum of 4 feet for frost protection.

Within the plant area, approximately 18 inches of crushed stone (stone drainage course) will be placed between the in-situ rock and the concrete slab. In this case, a modulus of vertical subgrade reaction of 600 kcf may be used for design of the plant foundation. A coefficient of friction to use, both between the slab and the stone draining course, and the stone drainage course and the bedrock surface, is 0.55.

5.7.2 Rock Foundations

The following methods have been used in the determination of the allowable bearing capacity of rock:

1. Use allowable values provided by the Local Building Code (TABLE 11-2, ALLOWABLE SOIL BEARING PRESSURES, Paragraph 27-678 of the New York City Building Code). Values may be reduced to account for weathering, fracture intensity, lateral confinement, or non-homogenous rock, based on the information of subsurface conditions and application of some judgement.

2. Use large safety factors in rock capacity in relation to RQD and unconfined compressive strength of intact rock.

Table 4-2 in Section 4 shows that about 89 percent of the rock below Elevation 165 belongs to Classes 1-65 and 2-65 and the remaining 11 percent to Class 3-65 of the New York City Building Code. RQD values higher than 75 percent (good to excellent rock) are of the order of 78 percent for foundations below Elevation 165.

As a result of this analysis and a review of rock core data presented on the boring logs, a bearing capacity of 80 ksf is deemed to be the most practical value for the overall rock conditions. This value is indicative of a rock that is moderately strong and has a moderate fracture spacing and, therefore, it should be adopted as the design allowable bearing capacity, corresponding to Class 2-65 rock for all foundations in bearing. The proposed structure is in deep rock and will be supported by a structural mat foundation bearing on bedrock. This foundation system requires a low bearing capacity with respect to rock bearing values. Consequently, a 3-65 rock class bearing value (40 ksf) could be sufficient for support of many areas of the structure. Provisions, however, should be made in the specifications for rock of a very low capacity that could be encountered in the foundation areas. Low quality bedrock could be either removed, trimmed or treated to enhance the bearing capacity.

Determination of the permissible bearing pressure can also be made from the compressive strength of intact rock by applying a factor of safety that should be somewhat dependent on RQD. In general, the allowable rock bearing pressure is taken in the range of one-fifth to one-tenth the UCS, using RQD as a guide, for instance, one-tenth for a small RQD. Depending on the rock quality, a reduction factor should also be considered. If the design compressive strengths, for example, were based on the average strength of 9,800 psi for all rock types encountered at the site, a RQD of 80 percent, and a safety factor of 7, the allowable rock bearing pressure would be about 129 ksf. This result shows that the method of calculating the bearing capacity by the compressive strength gives, generally, a higher value than that estimated from the Building Code. However, the allowable bearing capacity from the Building Code should be used to account for a wide range of geological conditions that may occur. Increases in the allowable bearing capacity due to embedment of the foundations will be made as required in accordance with the New York City Building Code, Table 11-2, Note (8).

5.8 LATERAL PRESSURES FOR FOUNDATION WALLS

The recommended lateral pressures for design of foundation walls are presented in Figure 5-1. Under the current conceptual design, a maximum 40-foot wide rock bench will be exposed along the entire periphery of the plant to provide a working platform. The actual top of bedrock varies. For simplicity, lateral pressure diagrams for two tops of rock elevations, respectively Elevation 160 and Elevation 185, are shown. The lateral pressure diagram with a top of rock elevation of 160 feet is applicable along the east side of the plant and part way on the north and south faces. Everywhere else along the periphery of the plant, the lateral pressure diagram with a top of rock elevation of 185 feet applies.

5.8.1 Hydrostatic Pressure

Based on the proposed project design, the groundwater will be permanently lowered below the lowest foundation level. Hence, no hydrostatic pressure will act on foundation walls.

5.8.2 Static Soil and Rock Lateral Pressures

Since the natural soils will be stripped to the top of rock and a wide bench will be excavated at the top of rock, the actual soils behind the final walls of the plan will be compacted select common fill. Since the walls will be drained, static lateral pressures for backfill soil are based on at-rest condition assuming a moist unit weight of 125 pcf and a friction angle of 34 degrees for which k_0 (at-rest earth pressure coefficient) is equal to 0.44. This corresponds to an equivalent fluid pressure of 55 pcf/ft. A surcharge lateral pressure due to a vertical surcharge of 300 psf, is added to the soil lateral pressure to account for construction loads. The depth of influence for a surcharge load is considered to be about 30 feet.

Based on experience with competent gneiss in the New York City area and since the rock walls will be permanently stabilized with rock bolts, and shotcrete, a ratio of horizontal to vertical pressure equal to 0.1 (k_0 = 0.1) is recommended for design of plant walls cast against a bond breaker membrane attached to the rock face. A moist unit weight of 168 pcf is used for bedrock. The lateral pressure at the top of rock should be taken as the earth overburden pressure at the top of rock multiplied by 0.1.

5.8.3 Seismic Soil and Rock Lateral Pressures

The structure will be designed with a structure stiffness to permit one inch of sway under seismic conditions. This amount of sway is sufficient to mobilize seismic active earth pressures. Under these conditions, the active earth pressure coefficient in soil is $K_a = 0.28$. The active pressure in rock is calculated using $K = 0.1$. The seismic lateral pressures are also based on the New York City Seismic Code procedure for which the total load expected during an earthquake is $P = 0.045\gamma h^2$, where γ is the unit weight of the soil and h is the height of the wall. Then, only in the overburden, the load P is superimposed to the active earth pressures. Since the rock mass will be stabilized by rock bolting and shotcrete, the rock walls will behave as a relatively stable rock mass. Therefore, there will be no additional seismic load to apply below the bedrock surface. Consequently, the seismic lateral force given by the above NYC Seismic Code formula shall be computed only in soil to the top of rock. This force is distributed as an inverted triangle between ground surface and the top of rock and superimposed to the active earth pressures. The active seismic design pressures, including the seismic lateral load, is shown on Figure 5.1. For the active seismic case, in accordance with the NYC Seismic Code, no calculation is made for the temporary vertical surcharge of 300 psf.

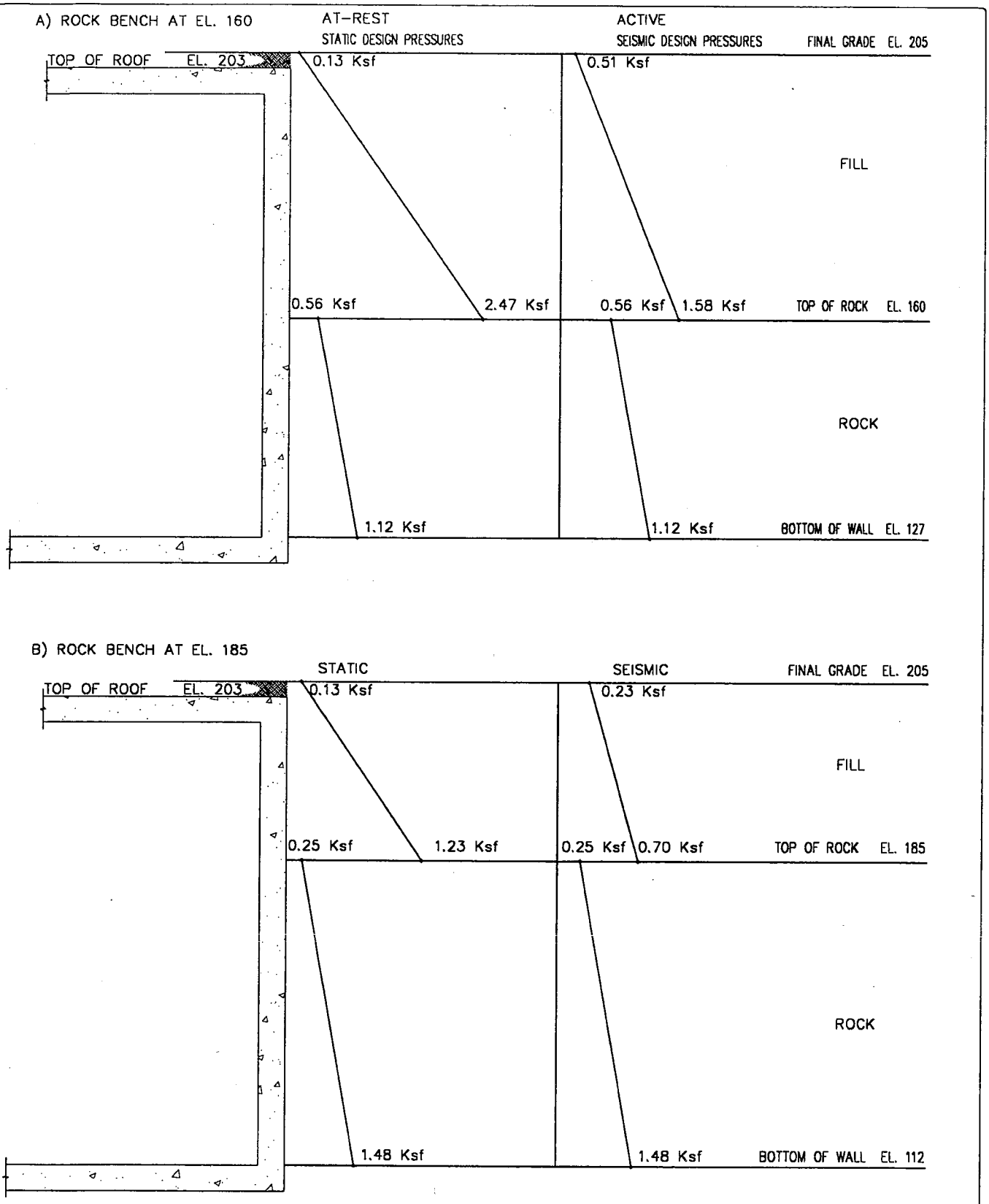


Figure 5-1
Lateral Pressure Diagrams for Design of Foundation Walls
Croton Water Treatment Plant at Mosholu Golf Course
Van Cortlandt Park, Bronx, New York

5.9 PERMANENT SOIL RETENTION SYSTEMS

Gravity type retaining walls shall be designed for the same lateral pressures as foundation walls, except that active conditions (i.e., k_a=0.28) instead of k_0 shall apply to overburden soils or backfill. This corresponds to an equivalent fluid pressure of 35 pcf/ft. All permanent soil retaining systems shall be provided with a drain to prevent build-up of hydrostatic pressures behind the wall. Lateral pressures for tied-back or anchored soil retention systems, if selected, shall be designed on a case by case basis.

SECTION 6
RECOMMENDED FOUNDATIONS AND WALLS

6.1 FOUNDATIONS

The geotechnical sections presented in Volume 2 of this Report show the outline of the Croton Water Treatment Plant. Although the plant will have several foundation levels, the entire structure will founded on bedrock. The foundation will consist of a structural mat of varying thickness resting over an 18-inch thick crushed stone layer. The crushed stone layer will play a dual role. It will provide cushioning to allow for minor differential movement between differentially loaded areas of the structure as well as serve as part of the underdrain system for the plant.

The foundation mat shall be designed for the allowable bearing capacity or the vertical subgrade reaction as recommended in Section 5 of this Report. Since the groundwater level will be permanently lowered, the foundation mat will not be subjected to hydrostatic uplift forces.

The rock wall between the various foundation levels should be excavated as vertically as is practically possible. In case of rock overbreak from blasting on the walls, the resulting void should be filled with concrete or shotcrete depending on the size of the void. In the foundations, voids created by blasting in good quality rock can be filled with crushed stone.

6.2 WALLS

The foundation walls shall be designed for the soil and rock lateral pressures presented in Section 5 of this Report. Again, because the groundwater level will be permanently dewatered, hydrostatic pressures will not build-up behind the foundation walls. The foundation walls would be poured against a bond breaker membrane attached to the stabilized rock face. The bond breaker membrane could be a geodrain net (GDN) with a smooth polyethylene membrane toward the side of the concrete, attached to the rock face. In order to minimize the volume of concrete fill, the rock wall shall be excavated as vertical as is practically possible and a limit for payment for rock overbreak will be specified. Above bedrock, the walls shall be formed on both sides and suitable backfill material or crushed rock shall be used as backfill behind the walls.

6.3 DEWATERING SYSTEM

The underdrain and pumping system for the Croton Water Treatment Plant shall be automated and designed with sufficient redundancy to assure uninterrupted operation for the life of the facility. The basic components of the underdrain are as follows:

- An 18-inch thick layer of ¾-inch coarse aggregate shall be placed continuously beneath the foundation mat. In general, a geotextile fabric will not be required over the entire subgrade. The use of geotextile fabric will be restricted to strips only over large soil filled joint opening identified during foundation inspection if required.

- Perforated 4-inch diameter HDPE pipes shall be placed at a close spacing (i.e., about 25 feet) in a North-South direction. These lateral drain pipes shall connect to 8-inch header pipes, which in turn will connect to pump sumps located within the footprint of the building. Each lateral drain pipe and header pipe shall be provided with frequent cleanouts to allow for periodic flushing and removal of possible deposits and encrustation. Detailed design with flat or slightly sloped drains will be developed.

- Four-foot-wide strips of geocomposite drainage net (GDN) shall be securely fasten along the entire height of the rock wall and spaced approximately at 20-foot intervals around the periphery of the excavation. The GDN strips shall extend to meet the crushed stone layer underneath the foundation mat. The GDN shall be selected to resist the hydrostatic pressure from the wet concrete for the maximum height between construction joints in the foundation walls.

- Continuous monitoring of groundwater levels will be required.

SECTION 7
RECOMMENDED BLASTING METHODS AND ROCK REINFORCEMENT

7.1 BLASTING METHODS

7.1.1 Controlled Blasting

Controlled blasting techniques - presplitting, cushion blasting and line drilling - minimize overbreak and permit vertical wall design. At the site, a combination of controlled blasting techniques will be required to cut the excavation to accurate lines and around the several vertical corners proposed in the plant layout. Smooth wall blasting technique will be utilized in the Raw Water and Finished Water Tunnels.

7.1.2 Presplitting

The presplit surface is initiated along the open-cut excavation line by blasting instantaneously or on a short delay (less than 50 ms) between each hole a single row of closely spaced blastholes prior to detonating the primary (main) rounds. The presplit surface reduces the blast effects of the main round on the excavation perimeter wall. A spacing of 24 inches, center to center, and a blasthole diameter of 3 inches are typical. In most presplitting applications there is no subdrilling. Normally holes are stemmed on top 4 feet. The choice of which charges to use depends on the blaster. What is important is that the charges be less than the diameter of the blasthole and preferably not touching the blasthole walls.

Blasthole depth in presplitting is limited by the drilling accuracy of aligned holes which, in turn, is dependent on the quality of the rock mass. Presplit holes are commonly 25 to 40 feet deep.

It is essential that the holes start and remain in the presplit plane. The deviation of holes from the designed plane should not be greater than 4 inches at the bottom of a bench 40 feet high with a hole spacing of 24 inches. For closer hole spacing the allowable deviation should be less than 4 inches. These limits should be specified in the Contract Documents.

Careless presplitting may damage the fractured rock in the uppermost zone near the bedrock surface because liberated gas tends to migrate along these fractures and loosen the mass. This can be minimized by reducing the hole depth and spacing and by stemming carefully.

In relation to the main blast, presplitting and primary blasting are sometimes performed in one operation with the presplit and primary holes drilled at the same time. However, delays of 100 to 200 ms separate the two blasts. The final row in the primary pattern is commonly kept 3 to 4 feet from the presplit row. The outside rows closer to the presplit wall may be loaded lighter to reduce vibration and fragmentation.

7.1.3 Cushion Blasting

Cushion blasting - sometimes referred to as trim blasting - is a controlled blasting technique where a narrow berm is left to reduce damage to the final wall by the main blast. A single row of holes is drilled along the excavation line, loaded with light, well distributed charges, and fired after the main excavation is removed. The spacing of cushion blastholes is normally slightly larger than in presplitting. The annular space in the holes around the charges is filled with sand, crushed stone or gravel the entire column length. The cushion holes are fired instantaneously or with minimum delay between holes. Good hole alignment is essential and criteria for deviation from verticality are the same as for presplitting. Cushion blasting is often performed in combination with unloaded guide holes (line drilling) in non-linear faces. The burden (the shortest distance from blasthole to the rock free face) must be considered in the design of a cushion blast since the production round has been fired. Cushion blasting may be employed by the blasting Contractor in lieu of presplitting in areas of fractured rock in the upper bench, or at the east wall.

7.1.4 Line Drilling

This technique is usually used to protect critical sections of the rock faces and consists of placing a row of unloaded drill holes along the excavation line within 2 to 4 diameters of one another. These unloaded, closely spaced drillholes act as guides to cause cracks to form between them. Line drilling is also employed between presplit or trim blastholes to help guide the cracks and it is recommended prior to presplitting or cushion blasting where additional protection of the wall is or, in order to examine corners, for at least 10 ft. in both directions from a 90° outside corner; or

at the inside corner location. The plant layout at the site will require several outside and inside corners to be excavated by presplitting or cushion blasting in combination with line drilling holes.

In line drilling the primary blast is conducted to within two or three rows of the line-drilled row to decrease the burden. The powder factor should be reduced in the row of primary blastholes nearest the line-drilled rock.

7.1.5 Smooth Wall Blasting

Smooth wall blasting is the method to control overbreak in underground tunneling, consisting of drilling perimeter blastholes on an appropriate burden-to-spacing ratio, loading with light distributed charges and firing with, or after, the last delay period in the round. Smooth wall perimeter blastholes are typically 2 inches in diameter.

7.1.6 Main (Primary) Blasting For Open-Cut Excavation

Production blasting for open-cut excavation shall be designed as a function of fragmentation, ground vibration, airblast, and flyrock.

The selection of the proper blasthole diameter, along with the type of explosive being used, will determine the burden. All other blast dimensions are a function of the burden.

Large diameter blastholes (greater than 4.5 inches) also result in large burdens and spacing; hence, they tend to produce coarser fragmentation. Preferably, the use of small diameter holes (3.5 to 4.5 inches) would provide relatively low unit costs and permit fairly close spacing of holes. This close spacing allows for better distribution of explosives through the rock mass which in turn produces better breakage. An additional advantage using small diameter blastholes is the reduction in the amount of explosive, which in turn reduces ground vibrations. Airblast and flyrock often occur due to an insufficient stemming column (collar distance) above the explosive charge. The ratio of collar distance to blasthole diameter required to prevent airblast and flyrock varies typically from 14:1 to 28:1. A larger collar distance is required where the seismic velocity of the rock exceeds the detonation velocity of the explosive or where the rock is heavily fractured or low in density, e.g., in the fractured zone near the rock surface.

On this regard, the burden design should consider a value of the Stiffness Ratio (bench height divided by burden distance) greater than 2, for good control and fragmentation. An insufficient burden will cause explosive airblast and flyrock, while too large a burden will produce inadequate fragmentation, toe problems and excessive ground vibrations.

Where adequate fragmentation in the stemming zone of the blasthole cannot be attained while still controlling airblast and flyrock, deck charges or small diameter satellite blastholes (mid-spaced with the blastholes) may be required. Good fragmentation, in order to provide as practicable as possible a well-graded material to reduce void ratio and limit the quantity of material requiring haulage off-site, will be required at the site. When the gneiss is broken in a uniform size, it will occupy on the average, 30 to 40 percent more volume (swell factor) than in its solid state.

Ground vibrations are controlled by reducing the weight of explosive fired per delay interval. The use of ms (millisecond) delays between holes in a row results in better fragmentation and reduces the ground vibrations and airblast. When ms delays are used between holes in a row, the spacing-to-burden ratio must also be reduced (1.5 is a typical value). Various delay patterns may be used within the rows. In the primary blast, the delay time between rows should be two to three times the delay time between holes in a row, to obtain good fragmentation and control flyrock. Despite careful planning and good blast design, flyrock may occasionally occur and must always be protected against, for instance, using blasting mats. Some margin for error must always be maintained. An adequate number of guards must be posted at safe distances. Any people within this perimeter must be adequately warned.

In blasting for civil engineering structures where a final grade is specified, subdrilling of final lift is normally restricted. The final lift in structural excavations is normally limited to 5 to 10 feet. Subdrilling is not allowed in the last 5-foot lift, and is limited to a maximum of 2 feet for the 10-foot lift. Depth of subdrilling between the intended bottom of the bench is generally 0.2 to 0.3 times burden. The diameter of the blasthole in the foundations is limited to a maximum of 3.5 inches.

In view of the rock conditions at the project site, which can be defined as being generally good, using a careful presplitting and a production blasting with delay patterns to improve maximum relief to the main blastholes nearest the presplit line, overbreak would not be a major concern.

The excavation can be opened by a deep "V" cut where an initial cut is lacking. The cut is then enlarged to establish the free face. The more free faces a blast has to break, the lower the powder factor requirements. Normally, an elongated cut blast pattern opens in the center and progresses toward each end by means of delays.

As bench heights in cuts through hilly topography change continuously, burden and blasthole spacing must be modified accordingly to comply with the irregular bedrock surface. In practice, bench height for the production blast coincides with the height of the presplitted wall. At the site, a maximum bench height of 40 feet is recommended.

7.2 LIMITATIONS ON GROUND VIBRATIONS AND AIRBLAST

7.2.1 Ground Vibrations

Blast vibration levels must be limited to minimize environmental impact, damage to nearby structures, and damage to the rock walls of the excavation.

To check blast vibration levels, there will be a requirement in the specifications for vibration monitoring, and a program of trial blasting in which the blast pattern is progressively modified to achieve the required results. Seismographs can be used throughout the blasting program to record the peak particle velocities and frequencies generated by the blasting rounds, measuring three mutually perpendicular components (radial, tranversal, vertical). Seismograph records provide excellent evidence in case of later complaints or law suits on damage or nuisance from blasting.

An effective method for reducing vibrations is to use delayed detonation and sequential blasting so that the vibrations from one line of blastholes can dissipate before the next row is detonated. Alternatively, short delays can be timed such that vibrations from one line of blastholes can dissipate before the next row is detonated, or that vibrations are out of phase with those from adjacent decks, holes and rows. Ground vibration levels are related more to the weight of the explosive in any one short-delay period than to the total explosive in the round. In general, an increase in the number of delay intervals does not affect the vibration level provided that the delay interval is greater than 8 ms and the charge weight per delay remains constant.

Permissible vibration levels are specified in relation to the levels that can be tolerated by the wall rock, by different types of structures and by people. A safe blast is one that is within regulatory particle velocity specifications or scaled distance specifications. Where vibrations are not a serious problem, regulations will often permit the blaster to use the scaled distance equation rather than measure vibrations with a seismograph. For this project, only particle velocity and frequency measurements will be specified. However, the Contractor may use scale distance in combination with particle velocity measurements, for a series of test shots prior to the actual blasting program to calculate typical charge weights and distances, that will produce vibration levels less than the specified particle velocity.

As low-frequency vibrations have greater potential for damage than high-frequency vibrations, this imposes more restrictive limits on vibrations with low frequencies and long durations. Frequencies in the range of 4 to 20 Hz are usually considered the most annoying and troublesome. Regulations restrict the ground vibrations to a peak particle velocity of 0.75 ips when frequencies fall in the range of 4 to 11 Hz and 1.0 ips for frequencies of 11 to 15 Hz. For frequencies of 15 to 40 Hz, the peak particle velocity varies linearly from 1.0 ips to 1.75 ips with 1.5 ips at 20 Hz and 1.75 between 30 and 40 Hz. For frequencies above 40 Hz, the maximum allowable particle velocity is 2.0 ips.

Where blasting operations are to continue during concrete operations, the blasting vibration limits for mass concrete are 0.75 ips for a concrete age of 0 to 24 hours from placement, and 1 ips for a concrete age of 24 hours to 72 hours. Ground vibration and airblast will be monitored at each blast at the Woodlawn Elevated Subway Station and on structures along Jerome Avenue.

7.2.2 Airblast

Airblast and airblast vibrations are generated when explosives are detonated in stemmed blastholes and high pressure gases are released to the atmosphere either through the broken rock or after the stemming has been ejected or by exposed detonation cord and surface delays intentionally placed on the ground surface. The primary causes of excessive airblast pressures are insufficient burden, insufficient stemming in each blasthole, and adverse weather conditions. The term airblast overpressure is often used for the air waves generated by blasting, and it is measured in pounds per square inch (psi).

Sometimes, airblast pressures are reported in decibels (dB), that is, a sound pressure level. 0.0145 psi is equivalent to 134 dB or 1 millibar. The primary blast-design parameters which contribute to the intensity of the airblast pressure are the charge weight per delay interval, and the distance from the charge (depth of burial usually considered to be the depth to the center of the charge). The distance is scaled by the cube root of the maximum charge weight per delay ($ft/lbs^{1/3}$). The charge per delay interval is the sum of the charges in the holes that are detonated simultaneously. The scaled depth of burial corresponds roughly to the scaled burden for each blasthole.

If overpressures are increased to the level of 0.1 psi or 151 dB, at which some type of damage to residences begins to develop, the results are noted in the form of occasional window breakage. At 1 psi or 171 dB there will be a general window breakage. Plaster will crack at 2 psi or 176 dB. The construction blasting specifications required for this project will limit the airblast overpressure to 0.0145 psi or 134 dB, which has a proven history of application.

Airborne pressures are recorded generally by microphones for pressure measurements from 0.1 to 1 psi, and by piezoelectric pressure gages for overpressure greater than 1 psi. Additionally, in the absence of monitoring, a scaled distance of 500 $ft/lbs^{1/3}$ is normally recommended. However, in this case, a more conservative 1 lb of explosive per delay will be allowed at a distance of 500 feet.

Although airblast damage from planned blasting operations is unusual, it is proposed to monitor all blasting operations.

7.3 BLASTING SPECIFICATIONS

Blasting specifications should require the Contractor to engage the services of a blasting specialist with a long proven blasting project record for designing and directing each blast. The Contractor shall submit blast designs for the Engineer's approval before the start of drilling and loading, and furnish complete information on every blast. Approval does not relieve the Contractor of his responsibility for safety, for producing the specified results, and for obtaining breakage sufficient for handling the broken rock. Provisions should be included for a vibration and airblast control and for the various types of controlled-perimeter blasting that may be required at different locations. When blasting results are desired to produce a certain ground

vibration level and a certain fragmentation, test blasting should be performed prior to the actual blasting program. A pre-construction survey that documents the conditions of the buildings and subway on Jerome Avenue should be performed prior to blasting. In addition, a pre-blast survey helps the blasting Contractor maintain good community relations. Another purpose of a pre-blast survey is to provide a baseline record of the conditions of the structures against which the effects of blasting can be assessed. When combined with a post-blast survey, this will help assure equitable resolution of any blast damage claims.

It is customary in construction contracts that unit bid prices for rock excavation be specified, including all costs of drilling and blasting. If the rock outlining the excavation is to be protected, it is common practice to describe the results required of the excavation stating that any rock excavation that exceeds the prescribed tolerance of lines and grades will be filled with concrete cast monolithically with the plant walls and that any additional cost necessary to do this be at the Contractor's expense. It is the responsibility of the Contractor to select the methods and operate in a manner that will produce the required results. It is expected that a Contractor will include in his bid a contingency item based on his judgement of the difficulty of the required work.

Specifications shall stress the fact that large holes and large spacings cannot be used to give maximum production at the expense of increased vibrations and damage to the perimeter. A range of blasthole sizes, as well as maximum heights of bench and depth tolerances of subdrilling, should be specified, and the bench heights should be linked to the installation of rock support before blasting of a subsequent bench.

The specification should state allowable maximum vibration and airblast levels together with locations and methods of vibration and airblast monitoring. This gives the Contractor greater flexibility, allowing him to come up with low-cost, high-production blast designs while demonstrating that his design is adequate for control of vibrations and damage.

Specifications for controlled-perimeter blasting should also give guidelines on stemming materials and hole alignment tolerances, and should state the use of either simultaneous firing or millisecond delays to reduce ground vibrations as required. Specifications for presplitting and cushion blasting should allow enough latitude that the method can be adjusted to the field conditions.

Unloaded perimeter holes are specified for line drilling. Provisions for unloaded guide holes and line drilling especially for outside corners should be considered.

A performance specification is preferred for excavation work as it leaves the detailed methods of construction up to the Contractor. The specification should state the required end-result in terms of lines of excavation, overbreak, vibration and noise levels, etc., and the general methods thereby these results can be achieved.

7.4 ROCK BOLTING

For permanent applications, the use of fully grouted rock bolts will be considered. The bolts can be either cement grouted, mechanically anchored hollow core bolts with an expansion shell for the anchorage, or resin anchored bolts using a number of setting resin cartridges in the anchorage zone.

In the resin bolt application, a number of fast-setting resin cartridges are inserted at the bottom of the drillhole for anchorage, followed by low-setting cartridges. The bolts can be tensioned within two or three minutes of installation (after the fast anchor resin has set). The tension is then locked in by the later-setting grout cartridges and the resulting installation is a fully tensioned, fully grouted rock bolts. When the bolts are longer than 15 feet, it is recommended to use hollow core mechanically anchored rock bolts that can be fully grouted with a water - cement grout. The grout will also offer a long-term corrosion protection. Pull-out tests will be required at least on 5 percent of the bolts installed for final acceptance.

When conditions are such that installation of support can be carried out very close to an advancing blast or in vertical installation, e.g., to pin down the top layers of rock, cement-grouted dowels can be used in place of rock bolts. The difference between rock bolts and dowels is that tensioned rock bolts apply a positive force to the rock, while the load in the dowels is generated by movements in the rock mass. Once the grout has set, a faceplate and nut may be fitted onto the end of the dowel and pulled up tight.

7.5 SHOTCRETE

Rock reinforcement, where required, can be achieved by applying a layer of shotcrete to the rock surface. The traditional reinforcement in shotcrete is steel-welded wire mesh. However, the trend is to replace the wire mesh in shotcrete with steel fibres. The ductility of steel fibres is higher than of wire mesh. However, in very poor quality, loose rock masses, the wire mesh still provides a significant amount of reinforcement, in combination with shotcrete. For normal applications, steel fibres offer savings in direct cost (material) and time (application of one layer of shotcrete with steel fibres as opposed to two layers with wire mesh). Moreover, the increased rebound caused by wire mesh, as well as the effect of shadows behind the mesh, is avoided. The fibre-reinforced shotcrete will require the use of microsilica in the mix and preferably a wet-mix process. The thickness of the fibre reinforced shotcrete layer should be minimum 2 inches; the thickness of the conventional shotcrete with wire mesh should be minimum 4 inches. The specifications should consider the use of both types of shotcrete for rock mass stabilization, depending on the quality of rock identified during rock wall inspection. For other purposes, such as shotcrete strips on the walls for the dewatering system, the use of steel fibre shotcrete is preferred.

SECTION 8
SITE WORK AND ACCESS ROADS

8.1 SITE GRADING AND BACKFILL

Crushed stone will be backfilled beneath the plant base slab and around the walls above the bedrock. The roof of the proposed Water Treatment Plant will be covered with about 2 feet of sandy loam and topsoil. Grass would be planted and an irrigation system would be installed to ensure successful maintenance of grass on the new driving range. The final grade would be at Elevation 205, approximately at the existing grade at the western side of the project site, and 30 feet above the existing grade at the eastern side of the project site. This change in grade would be handled with vegetated sloping berms constructed with excavated material and imported fill as required.

8.2 ROADS AND PARKING AREAS

Paved areas, including permanent parking lots and access roads, will be constructed on properly prepared subgrade. The exposed subgrade shall be proofrolled to densify the soil. Due to a relatively high silt content that exists in the subgrade soils, this type of material may weave when exposed to excessive moisture and traffic. As a result, in the softer areas of the subgrade, the material must be replaced with new compacted coarser fill (sand and gravel with less than 15 percent silt). A 2-inch maximum size, well graded crushed stone or structural fill subbase must be provided over the subgrade and/or fill as a means of subpavement support and drainage layer. Geotextiles may be used as reinforcement in soft road subgrades as required.

Pavement will consist of 1.5-inch thick top asphaltic concrete wearing course and 4-inch thick bituminous binder course overlying a 12-inch thick stone subbase, compacted to 98 percent of maximum dry density. Design and materials will conform to specifications of New York City Department of Transportation.

Typical minimum California Bearing Ratio (CBR) values for base, subbase and subgrade materials upon which pavement design thicknesses are based, are as follows:

1. **Base.** Well graded clean crushed stone, nominal size 1-in. (80 to 100 percent passing by weight) to No. 200 sieve (0 to 10 percent). CBR 80 percent (soil rating: very good).
2. **Subbase.** Well graded crushed stone, nominal size ¾-in. (90 to 100 percent passing by weight) to No. 200 sieve (0 to 12 percent). CBR 20 percent (good).
3. **Subgrade.** Existing silty sands, poorly graded sand-silt mix, medium dense, moist. CBR 10 percent (acceptable).

SECTION 9
CONSTRUCTION CONSIDERATIONS

9.1 SOIL EXCAVATION AND HAUL ROADS

The overburden soils at the site can be excavated with standard earth moving equipment. The soils will be laid back to form an embankment with slopes no steeper than 1.5 horizontal to 1 vertical, to provide for adequate stability during construction. Alternatively, the Contractor may opt to construct steeper slopes supported by earth retention relocation system, in which case the Contractor shall be required to retained a Professional Engineer registered in the State of New York to design the system.

The embankment slopes will be stabilized with geotextile material, such as an erosion mat, and planted with grass to minimize erosion.

A paved haul road will be constructed from Jerome Avenue to the top of the existing Golf Course along the north and west sides of the plant. The Contract Documents will specify that the overburden excavation will extend up to a maximum of 40 feet beyond the footprint of the plant to create a rock platform around the entire plant serving as a working platform and for haulage of the excavated material. As the overburden is removed, temporary ramps can be constructed as required from the embankment down to the working platform. As rock excavation proceeds below the working platform, lower ramps will be built within the excavation footprint to allow vehicular access to the bottom of the excavation.

The paved haul roads installed during construction, as well as the granular material placed on the fairways to facilitate parking and laydown areas, will be removed. All these areas will be restored in accordance with plans to be developed.

9.2 ROCK EXCAVATION AND TEMPORARY ROCK WALL REINFORCEMENT

Blasting methods for rock excavation and temporary rock wall measures that will be required are discussed in Section 5.5 and Section 7 of this Report.

9.3 DEWATERING

The pumping rate for design of the permanent underdrain system is estimated to be in the order of 110 gpm based on calculation on groundwater inflow. Dewatering rates during construction will include stormwater and can vary substantially from the 110 gpm underdrain design rates. Given the size of the excavation and the time it will take to complete it, dewatering during construction will likely be accomplished with sump pumps placed inside the excavation. Pumped water will be discharged into a nearby sewer. Provisions to handle concentrated flows such as grouting of more significant water-producing fractures will need to be implemented.

Drainage should be provided for the foundation walls. Below the top of rock geodrain strips will be installed and connected to the foundation drain. Above the top of rock, if select common fill is used as backfill, a peripheral drain along the rock bench should be provided to allow the groundwater from the compacted backfill to drain freely. A simple option would be to extend the geodrain strips horizontally 10 feet on top of the rock bench and cover it with one foot of ¾-inch stone. Alternately, a peripheral drain can be installed on top of bedrock to drain by gravity to either the foundation sump or to one of the sewers on Jerome Avenue. If on-site silty sands are allowed as backfill behind foundation walls, the geodrain strips should be extended for the full height of the foundation walls.

SECTION 10
INSTRUMENTATION AND MONITORING

10.1 GEOTECHNICAL INSTRUMENTATION

Geotechnical instrumentation during construction will consist of observation wells to monitor the groundwater, and survey monitoring points and rock bolt extensometers on the rock face of excavation to monitor movement of the rock. A minimum of eight observation wells are recommended around the perimeter of the excavation area. Observation wells will be extended from the ground surface to 5 feet below the final excavation level. The well screen depth should be from 5 feet above the bedrock surface to the bottom of the borehole. Some observation wells will be permanent, some others should be properly backfilled at the end of construction.

Rock bolt extensometers will be used on each wall to detect vertical wall movement toward the excavation. They will be installed in areas where major joint intersections may form potentially unstable wedges of rock. A minimum of 6 rock bolt extensometers would be required on the long walls of the excavation and 4 on the short walls. Additional instrumentation such as survey points and tell-tale mortars on major joints will be installed as necessary. Survey points should be located on each wall bench at 100-foot intervals.

Permanent geotechnical instrumentation after completion of construction will consist of pneumatic or vibrating wire piezometers to monitor the groundwater in the underdrain beneath the plant.

END OF SECTION
THIS PAGE INTENTIONALLY LEFT BLANK

MEMORANDUM

TO:	**Jean M. Jean-Louis, Director** **NYCDDC – Office of Geotechnical and Environmental Services** **30-30 Thomson Avenue** **Long Island City, New York 11101**
ATTN:	**Abdiel Lopez-Torres, Project Manager**
FROM:	**LiRo Engineers, Inc.**
DATE:	**June 6, 2016**
SUBJECT:	**Limited Phase II Environmental Site Investigation (ESI)** **Croton Water Treatment Plant** **3851 Jerome Avenue** **Van Cortlandt Park** **Bronx, New York** **DDC Project Number: HED-CLUB** **WOL No. : 11505-LIRO-3-10529** **Contract Registration No.: 20151405569**

Introduction

On behalf of the New York City Department of Design and Construction (NYCDDC), LiRo Engineers, Inc. (LiRo) conducted a Limited Phase II Environmental Subsurface Investigation (ESI) at the Croton Water Treatment Plant (the Site) located at 3851 Jerome Avenue, in Van Cortlandt Park, Bronx, New York (Figures 1 and 2) to characterize and assess the subsurface soils at the Site. The Limited Phase II ESI was performed to determine if the Site's environmental condition might impact proposed construction activities at the Site.

Site Description

The Site is located at 3851 Jerome Avenue within Van Cortlandt Park in Bronx, New York and was undergoing active maintenance and construction at the time of the field activities. The proposed work at the Site related to this Limited Phase II ESI field activity includes excavation for the construction of a golf clubhouse structure.

Scope of Work

As requested by the NYCDDC, LiRo conducted an expedited Limited Phase II ESI of the Site. This work was assigned as a priority project prompting an expeditious completion deadline due to the abbreviated project schedule and a Phase I Environmental Site Assessment (ESA) was not performed for the Site. The objective of the Limited Phase II ESI was to assess the presence of any subsurface contamination that may potentially impact proposed excavation activities.

On May 7, 2016, Ms. Eva Jakubowska of LiRo and the NYCDDC Project Manager conducted a walk through of the Site to select boring locations. In addition, it was determined during the walk through that the borings would need to be advanced to varying depths ranging from 6 to 20 feet below grade (ftbg), depending on location at the Site.

The Phase II ESI activities were conducted between May 24 and 26, 2016 and consisted of the following components:

- The advancement of seven (7) borings (SB-01 through SB-07). Each boring was hand cleared to 6 ftbg using a vacuum excavator/air knife combination. Borings SB-02 through SB-07 were then advanced to their terminal depths indicated above utilizing a GeoProbe with direct push technology through the pre-cleared locations. The depths of the borings were as follows:
  - SB-01 was advanced to 6 ftbg as planned;
  - SB-02 was advanced to 9 ftbg due to refusal;
  - SB-03 was advanced to 10 ftbg as planned;
  - SB-04 was advanced to 12 ftbg due to refusal;
  - SB-05 was advanced to 18 ftbg due to refusal; and,
  - SB-06 and SB-07 were advanced to 3.5 ftbg due to refusal.

- Field screening consisted of qualitative assessment of soils including obtaining photo-ionization detector (PID) readings, and identification of visual and olfactory indicators of contamination (staining, odors) from surface grade to the bottom of each boring. Soil samples were additionally classified in the field using the Unified Soil Classification System (USCS);

- The collection of one (1) grab soil sample from each of the seven (7) soil borings (SB-01 through SB-07). The grab soil samples were analyzed for United States Environmental Protection Agency (USEPA) Target Compound List (TCL) volatile organic compounds (VOCs);

- The collection of one (1) composite soil sample from each of the seven (7) soil borings (SB-01 through SB-07). The composite soil samples were analyzed for the following parameters: (1) Polycyclic Aromatic Hydrocarbons (PAHs) via USEPA Method 8270C; (2) Polychlorinated Biphenyls (PCBs) via USEPA Method 3550B/8082; (3) Total Petroleum Hydrocarbon (TPHC) Diesel Range Organics/Gasoline Range Organics (DRO/GRO) via USEPA Method 8015B; (4) Resource Conservation and Recovery Act (RCRA) Characteristics via USEPA SW-846; and, (5) Toxicity Characteristic Leaching Procedure (TCLP) RCRA Metals via USEPA SW-846;

- The preparation of this report, which includes tables summarizing the laboratory analytical results and figures depicting boring locations, significant site features and, if applicable, contamination occurrence and distribution.

Since groundwater was not encountered within any of the seven (7) boring advanced at the Site, no groundwater samples were collected.

In order to evaluate the subsurface soil quality, laboratory analytical results for the soil samples were compared with the regulatory standards identified in: (1) New York State Department of Environmental Conservation (NYSDEC) Subpart 375-6: Remedial Program Unrestricted and Restricted Use (Track 1 and Track 2) Soil Cleanup Objectives (SCOs); (2) NYSDEC CP-51 Soil Cleanup Levels (SCLs) which include Supplemental Soil Cleanup Objectives (SSCOs) to NYSDEC Subpart 375-6 and SCLs for

gasoline/fuel oil contaminated soil; and/or, (3) Toxicity Characteristic Regulatory Levels for Hazardous Waste published in RCRA and 6 New York City Code for Rules and Regulation (NYCRR) Part 371.

Field Activities

The seven (7) borings were cleared to 6 ftbg unless refusal was encountered sooner (i.e., SB-06 and SB-07 to 3.5 ftbg) using a vacuum excavator/air knife combination. Boring SB-02 through SB-05 were then advanced to their terminal depths utilizing a GeoProbe with direct push technology. Boring SB-01 was terminated at 6 ftbg as proposed.

Soil samples were collected using plastic scoops and/or disposable spoons. Soil boring locations are shown on Figure 3. The designations and sampling intervals for the soil samples that were submitted to the laboratory are included in Table 1.

Soil from each boring was classified and examined for visual evidence (i.e., staining, discoloration) and any olfactory indications (i.e., odors) of contamination. In addition, a PID was used to screen the soil for VOC vapors.

In order to identify representative conditions relative to the presence of PAHs, PCBs, TCLP RCRA Metals, TPHC-DRO/GRO, and RCRA Characteristics over the entire soil column in each boring, composite soil samples were collected by mixing the soil from the entire column in a stainless steel bowl. Boring composite samples were collected from the seven (7) soil borings (SB-01 through SB-07).

In order to identify representative conditions relative to the presence of VOCs, grab soil samples were collected from the bottom 6-inch interval of the borings of all seven (7) borings (SB-01 through SB-07).

All boring equipment was cleaned by rinsing with tap water, scrubbed with phosphate-free detergent (i.e., Alconox®), and then rinsed with deionized water again between each sample interval in accordance to NYSDEC protocols stipulated in the Division of Environmental Remediation (DER) -10. Following the completion of each boring, the open boreholes were back-filled with drill cuttings and restored to its initial surface grade with concrete patches.

The soil samples were submitted to Chemtech of Mountainside, New Jersey, a New York State Department of Health (NYSDOH) certified laboratory (No. 11376). Field derived Quality Assurance/Quality Control (QA/QC) samples (i.e., field blank, trip blank, duplicate) were not collected for this project. Laboratory analytical reports are included in Appendix A.

Field Observations

The subsurface soils encountered during this Phase II ESI consisted predominantly of brown fine to coarse sand with silt and gravel. Fill material, which included mainly blasted rock, was noted throughout the Site. Asphalt millings were noted within four (4) of the on-site borings at the following depths.

Boring No.	Depth (ftbg)
SB-02	7.5
SB-04	8.5
SB-05	0-2
SB-07	0.5-2

Refusal was met at SB-02 and SB-05 through SB-07. LiRo cannot be certain whether this was bedrock or not. Groundwater was not encountered within the seven (7) borings advanced on-site.

Field screening did not identify any visual or olfactory evidence of impacts or elevated PID readings within the soil borings.

Findings

Volatile Organic Compounds (VOCs) in Soil
VOCs were detected in all seven (7) grab soil samples collected. One (1) VOC, acetone, was detected above the Unrestricted Use (Track 1) SCO in one (1) of the seven (7) grab samples collected (SB-07). 1,2,4-triclorobenzene was detected in one (1) of the seven (7) grad samples (SB-02) at a concentration below the Unrestricted Use (Track 1) SCOs, Restricted Use (Track 2) Residential SCOs, and/or the CP-51 SCLs. Methylene chloride was detected in all seven (7) grab samples (SB-01 through SB-07) at concentrations below the Unrestricted Use (Track 1) SCOs, Restricted Use (Track 2) Residential SCOs, and/or the CP-51 SCLs. Both acetone and methylene chloride are common laboratory cross contaminants and are most likely not representative of subsurface conditions. Refer to Table 2 for a summary of the VOC detections.

Polycyclic Aromatic Hydrocarbons (PAHs) in Soil
PAHs were reported in two (2) of the seven (7) composite soil samples collected. Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene were all detected at concentrations below the Unrestricted Use (Track 1) SCOs, Restricted Use (Track 2) Residential SCOs, and CP-51 SCLs in the two (2) composite samples (SB-02 and SB-04). The detected PAHs may be attributed to: (a) residuals from potential isolated releases in this portion of the Site; and/or, (b) the presence of historic fill material placed at the Site. Refer to Table 3 for a summary of TCL PAHs detections.

PCBs in Soil
PCBs were not detected in any of the seven (7) composite soil samples collected. Refer to Table 4.

Toxicity Characteristic Leaching Procedure (TCLP) Resource Conservation and Recovery Act (RCRA) Metals in Soil
TCLP RCRA metals, including barium, chromium, and/or selenium, were reported in all seven (7) composite soil samples collected. All reported concentrations were below RCRA standards. Refer to Table 5 for TCLP RCRA metal detections.

Waste Classification of Soil
Ignitability (flash point), reactivity (cyanide and sulfide), and corrosivity (pH) were within the acceptable RCRA ranges. TPHC-DRO were reported in all seven (7) composite samples collected at concentrations ranging from 1.5 milligrams per kilograms (mg/kg) in SB-05 to 1,081 mg/kg in SB-07. There is no regulatory standard for TPHC-DRO. TPHC-GRO was not detected in the seven (7) composite samples collected. Refer to Table 5 for a summary of TPHC-DRO results.

Conclusions

Based on the results of the Limited Phase II ESI, which included the evaluation of the field screening data and the laboratory analytical results, and a comparison to applicable regulatory standards, the following conclusions are presented:

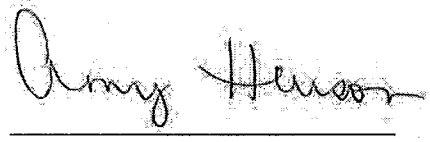
- Field screening did not identify any visual or olfactory evidence of impacts or PID readings within the soil borings;
- Laboratory analytical results did not identify petroleum-impacted soils at the Site. The presence of TPHC-DRO in the subsurface soils may be attributed to: (a) residuals from isolated releases; and/or, (b) the presence of fill material at the Site; and,
- The subsurface soil samples collected from the Site did not exhibit hazardous waste characteristics.

Recommendations

Based on the results of the field investigation and laboratory analytical results, LiRo recommends the following:

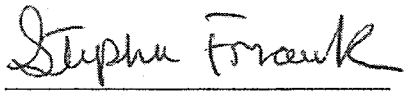
- The Contract documents should identify provisions for characterizing and managing, handling, transporting, and disposing of non-hazardous contaminated soil (i.e., TPHC-DRO) and a contingency for managing, handling, transporting, and disposing of petroleum contaminated soil. The Contractor should be required to submit a Material Handling Plan (MHP) to identify the specific protocol and procedures that will be employed to manage the waste in accordance with applicable regulations. Analytical results will need to be compared to levels acceptable by the chosen receiving facility to determine appropriate waste classification prior to off-site disposal;
- Due to the presence of TPHC-DRO in the investigated sites, dust control procedures are recommended during excavation activities to minimize the creation and dispersion of fugitive airborne dust. The Contractor may implement dust control measures to minimize potential airborne contaminants released as a direct result of construction activities;
- Based on the Limited Phase II ESI field activities, groundwater was not encountered within the seven (7) soil borings advanced at the Site. Should dewatering be necessary during construction activities to a sanitary or combined sewer, the contractor should be required to obtain a NYCDEP sewer discharge permit.
- In addition, if discharge into storm sewers (which ultimately discharge to surface waters) is required during dewatering, it may be done under the appropriate NYSDEC State Pollutant Discharge Elimination System (SPDES) permit. Additional sampling and laboratory analysis may be required to satisfy NYSDEC requirements prior to discharge into storm sewers; and,
- Before beginning any excavation activity, the contractor should submit a site-specific HASP that will meet the requirements set forth by the Occupational, Safety, and Health Administration (OSHA), the NYSDOH, and any other applicable regulations. The HASP should identify the possible locations along the Site and risks associated with the potential contaminants that may be encountered, and the administrative and engineering controls that will be utilized to mitigate environmental concerns (i.e., dust control procedures for TPHC-DRO).

Report Prepared By:



Amy Hewson
Senior Environmental Analyst

Report Reviewed By:



Stephen Frank
Senior Geologist

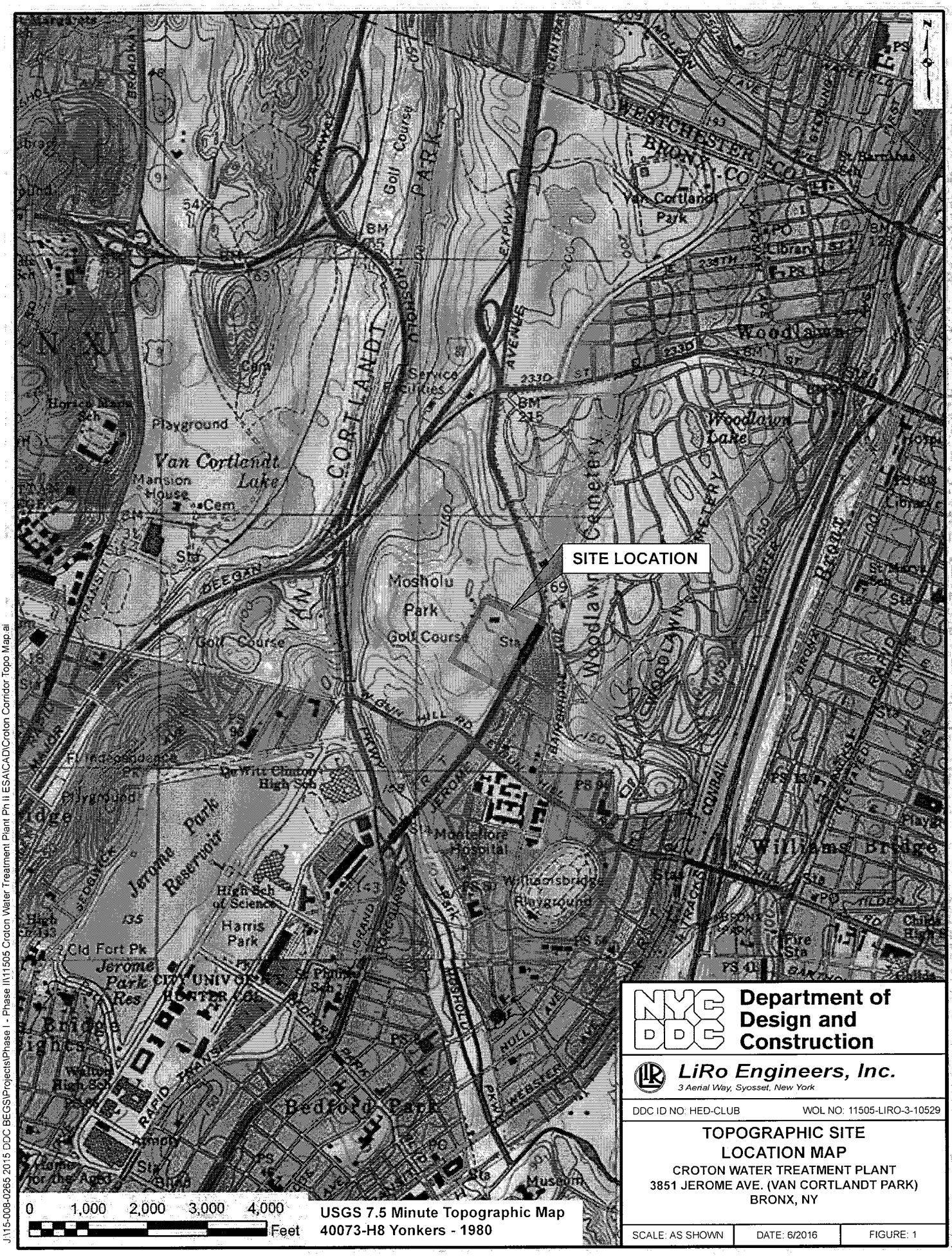
Report Reviewed By:



Robert Kreuzer
Project Manager

Figures	**1**	Topographic Site Location Map
	2	Site Area Map
	3	Sample Location Plan
Tables	**1**	Summary of Environmental Boring Data
	2	Summary of Target Compound List (TCL) Volatile Organic Compounds (VOCs) Detected in Soil
	3	Summary of Polycyclic Aromatic Hydrocarbons (PAHs) Detected in Soil
	4	Summary of Polychlorinated Biphenyls (PCBs) Detected in Soil
	5	Summary of Waste Characterization in Soil
Attachment	**A**	Laboratory Analytical Results
	B	Boring Logs

Figures



Department of Design and Construction

LiRo Engineers, Inc.
3 Aerial Way, Syosset, New York

DDC ID NO: HED-CLUB WOL NO: 11505-LIRO-3-10529

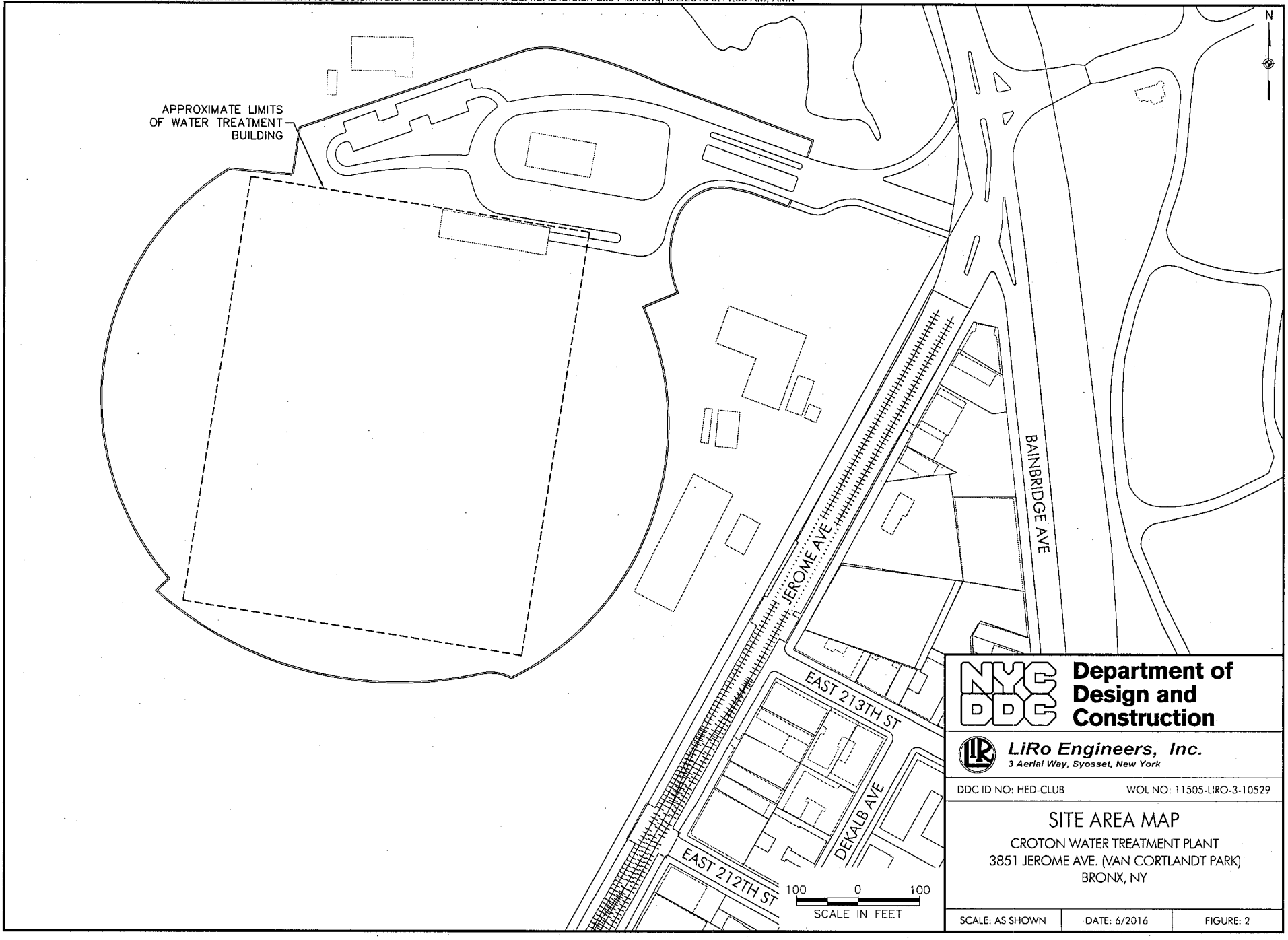
TOPOGRAPHIC SITE LOCATION MAP

CROTON WATER TREATMENT PLANT
3851 JEROME AVE. (VAN CORTLANDT PARK)
BRONX, NY

SCALE: AS SHOWN	DATE: 6/2016	FIGURE: 1

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\CAD\Croton Corridor Topo Map.ai

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\CAD\Croton Site Plan.dwg, 6/2/2016 9:11:06 AM, AMK



Department of Design and Construction

LiRo Engineers, Inc.
3 Aerial Way, Syosset, New York

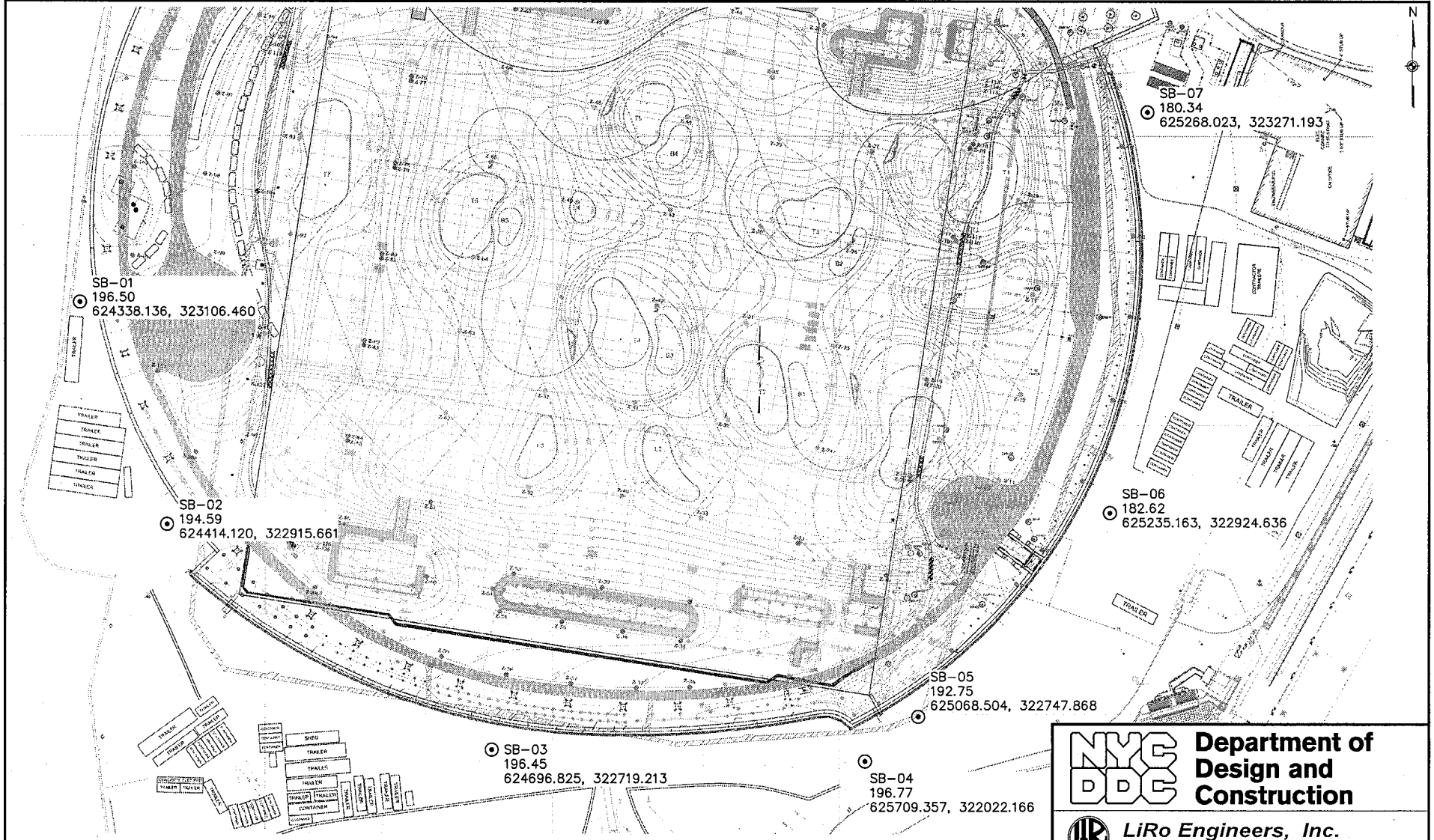
DDC ID NO: HED-CLUB WOL NO: 11505-LIRO-3-10529

SITE AREA MAP

CROTON WATER TREATMENT PLANT
3851 JEROME AVE. (VAN CORTLANDT PARK)
BRONX, NY

SCALE: AS SHOWN	DATE: 6/2016	FIGURE: 2

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\CAD\Croton Sample Location Plan.dwg, 6/2/2016 9:12:48 AM, AMK



Department of Design and Construction

LiRo Engineers, Inc.
3 Aerial Way, Syosset, New York

DDC ID NO: HED-CLUB | WOL NO: 11505-LIRO-3-10529

SAMPLE LOCATION PLAN

CROTON WATER TREATMENT PLANT
3851 JEROME AVE. (VAN CORTLANDT PARK)
BRONX, NY

SCALE: AS SHOWN	DATE: 6/2016	FIGURE: 3

Tables

Table 1. Summary of Environmental Boring Data
Phase II Environmental Subsurface Investigation for the Croton Water Treatment Plant
3851 Jerome Ave., Bronx, NY

Boring No.	Sample ID	PID (ppm)	Sample Interval (ftbg)	Total VOCs (ug/kg)	Total PAHs (ug/kg)	Total PCBs (ug/kg)	Depth to Water (ftbg)	Total Depth (ftbg)	Other Comments
SB-01	SB-01-5.5-6	<1	5.5-6	7	NA	NA	Not Encountered	6.0	No petroleum odors, visual evidence of impact, or elevated PID readings were detected.
	SB-01-COMP		0.5-6	NA	ND	ND			
SB-02	SB-02-8.5-9	<1	8.5-9	5	NA	NA	Not Encountered	9.0	No petroleum odors, visual evidence of impact, or elevated PID readings were detected. Refusal at 9 ftbg.
	SB-03-COMP		0.5-9	NA	1,990	ND			
SB-03	SB-03-9.5-10	<1	9.5-10	5	NA	NA	Not Encountered	10.0	No petroleum odors, visual evidence of impact, or elevated PID readings were detected.
	SB-03-COMP		0.5-10	NA	ND	ND			
SB-04	SB-04-11.5-12	<1	11.5-12	4	NA	NA	Not Encountered	12.0	No petroleum odors, visual evidence of impact, or elevated PID readings were detected. Refusal at 12 ftbg.
	SB-04-COMP		0.5-12	NA	3,640	ND			
SB-05	SB-05-17.5-18	<1	17.5-18	5	NA	NA	Not Encountered	18.0	No petroleum odors, visual evidence of impact, or elevated PID readings were detected. Refusal at 18 ftbg.
	SB-05-COMP		0.5-18	NA	ND	ND			
SB-06	SB-06-3-3.5	<1	3-3.5	8 / 11	NA	NA	Not Encountered	3.5	No petroleum odors, visual evidence of impact, or elevated PID readings were detected. Refusal at 3.5 ftbg.
	SB-06-COMP		0.5-3.5	NA	ND	ND			
SB-07	SB-07-3-3.5	<1	3-3.5	67	NA	NA	Not Encountered	3.5	No petroleum odors, visual evidence of impact, or elevated PID readings were detected. Refusal at 3.5 ftbg.
	SB-07-COMP		0.5-3.5	NA	ND	ND			

Notes:
All composite soil samples were analyzed for Polycyclic Aromatic Hydrocarbons (PAHs), Target Compound List (TCL) Polychlorinated Biphenyls (PCBs), Total Petroleum Hydrocarbon (TPHC) Diesel Range Organics/Gasoline Range Organics (TPHC DRO/GRO), Resource Conservation and Recovery Act (RCRA) Characteristics, and Toxicity Characteristic Leaching Procedure (TCLP) RCRA Metals.
NA = Not Analyzed/Not Applicable
ND = Non detect
ftbg = feet below grade surface
ppm = parts per million (or mg/kg)
ug/kg = microgram per kilogram

Table 2. Summary of Target Compound List (TCL) Volatile Organic Compounds (VOCs) Detected in Soil
Phase II Environmental Subsurface Investigation for the Croton Water Treatment Plant
3851 Jerome Ave., Bronx, NY

TCL VOC	Part 375-6.8 (a) Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Residential Soil Cleanup Objectives (SCOs)	CP-51 Soil Cleanup Levels (SCLs)	Sample ID, Date Collected, and Depth (ft bgs)							
				SB-01-5.5-6	SB-02-8.5-9	SB-03-9.5-10	SB-04-11.5-12	SB-05-17.5-18	SB-06-3-3.5	SB-06-3-3.5RE	SB-07-3-3.5
				5/25/2016	5/26/2016	5/26/2016	5/26/2016	5/26/2016	5/24/2016	5/24/2016	5/24/2016
				5.5-6	8.5-9	9.5-10	11.5-12	17.5-18	3-3.5	3-3.5	3-3.5
1,2,4-Triclorobenzene	NS	NS	NS	ND	1.1 J	ND	ND	ND	ND	ND	ND
Acetone	50	100,000	NS	ND	ND	ND	ND	ND	ND	ND	61 J
Methylene chloride	50	51,000	NS	6.7	3.8 J	4.7 J	4.4 J	4.7 J	7.7	10.7	5 J
Total VOCs	NS	NS	NS	7	5	5	4	5	8	11	67

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
ft bgs = feet below grade surface
NS = No Standard
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
J = Estimated value
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
CP-51 Soil Cleanup Levels (SCLs) = New York State Department of Environmental Conservation (NYSDEC) CP-51 – Soil Cleanup Guidance (CP-51) (October 21, 2010).

BOLD = Concentration exceeds NYSDEC CP-51 SCLs Table 1 - Supplemental Soil Cleanup Objectives (Residential), Table 2 - SCLs for Gasoline Contaminated Soils, Table 3 - SCLs for Fuel oil Contaminated Soil
Shading = Concentration exceeds Unrestricted Use (Track 1) Soil Cleanup Objectives
Italicized = Concentration exceeds Restricted Use (Track 2) Residential Soil Cleanup Objectives

Table 3. Summary of Polycyclic Aromatic Hydrocarbons (PAHs) Detected in Soil
Phase II Environmental Subsurface Investigation for the Croton Water Treatment Plant
3851 Jerome Ave., Bronx, NY

TCL SVOC	Part 375-6.8 (a) Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Residential Soil Cleanup Objectives (SCOs)	CP-51 Soil Cleanup Levels (SCLs)	Sample ID, Date Collected, and Depth (ft bgs)						
				SB-01-COMP	SB-02-COMP	SB-03-COMP	SB-04-COMP	SB-05-COMP	SB-06-COMP	SB-07-COMP
				5/25/2016	5/26/2016	5/26/2016	5/26/2016	5/26/2016	5/24/2016	5/24/2016
				0.5-6	0.5-9	0.5-10	0.5-12	0.5-18	0.5-3.5	0.5-3.5
Anthracene	100,000	100,000	100,000	ND	ND	ND	110 J	ND	ND	ND
Benzo(a)anthracene	1,000	1,000	1,000	ND	150 J	ND	350	ND	ND	ND
Benzo(a)pyrene	1,000	1,000	1,000	ND	180 J	ND	330 J	ND	ND	ND
Benzo(b)fluoranthene	1,000	1,000	1,000	ND	230 J	ND	370	ND	ND	ND
Benzo(g,h,i)perylene	100,000	100,000	100,000	ND	120 J	ND	180 J	ND	ND	ND
Benzo(k)fluoranthene	800	1,000	800	ND	120 J	ND	200 J	ND	ND	ND
Chrysene	1,000	1,000	1,000	ND	200 J	ND	330 J	ND	ND	ND
Flouranthene	100,000	100,000	100,000	ND	330 J	ND	670	ND	ND	ND
Indeno(1,2,3-cd)pyrene	500	500	500	ND	100 J	ND	170 J	ND	ND	ND
Phenanthrene	100,000	100,000	100,000	ND	230 J	ND	380	ND	ND	ND
Pyrene	100,000	100,000	100,000	ND	330 J	ND	550	ND	ND	ND
Total PAHs	NS	NS	NS	ND	1,990	ND	3,640	ND	ND	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
ft bgs = feet below grade surface
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
J = Estimated value
PAHs = Polycyclic Aromatic Hydrocarbons
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
CP-51 Soil Cleanup Levels (SCLs) = New York State Department of Environmental Conservation (NYSDEC) CP-51 – Soil Cleanup Guidance (CP-51) (October 21, 2010).

BOLD = Concentration exceeds NYSDEC CP-51 SCLs Table 1 - Supplemental Soil Cleanup Objectives (Residential), Table 2 - SCLs for Gasoline Contaminated Soils, Table 3 - SCLs for Fuel oil Contaminated Soil
Shading = Concentration exceeds Unrestricted Use (Track 1) Soil Cleanup Objectives
Italicized = Concentration exceeds Restricted Use (Track 2) Residential Soil Cleanup Objectives

Table 4. Summary of Polychlorinated Biphenyls (PCBs) Detected in Soil
Phase II Environmental Subsurface Investigation for the Croton Water Treatment Plant
3851 Jerome Ave., Bronx, NY

PCBs	Part 375-6.8 (a) Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs)	Part 375-6.8 (b) Restricted Use (Track 2) Residential Soil Cleanup Objectives (SCOs)	CP-51 Soil Cleanup Levels (SCLs)	Sample ID, Date Collected, and Depth (ftbg)						
				SB-01-COMP	SB-02-COMP	SB-03-COMP	SB-04-COMP	SB-05-COMP	SB-06-COMP	SB-07-COMP
				5/25/2016	5/26/2016	5/26/2016	5/26/2016	5/26/2016	5/24/2016	5/24/2016
				0.5-6	0.5-9	0.5-10	0.5-12	0.5-18	0.5-3.5	0.5-3.5
Total PCBs	100	1,000	NS	ND	ND	ND	ND	ND	ND	ND

Notes:
All concentrations are reported in parts per billion (ppb or ug/kg)
ftbg = feet below grade surface
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
NS = No Standard
SCOs = Soil Cleanup Objectives as per the NYSDEC Regulations 6 NYCRR Subpart 375-6 Remedial Program Soil Cleanup Objectives (December 14, 2006).
CP-51 Soil Cleanup Levels (SCLs) = New York State Department of Environmental Conservation (NYSDEC) CP-51 – Soil Cleanup Guidance (CP-51) (October 21, 2010).

BOLD = Concentration exceeds NYSDEC CP-51 SCLs Table 1 - Supplemental Soil Cleanup Objectives (Residential), Table 2 - SCLs for Gasoline Contaminated Soils, Table 3 - SCLs for Fuel oil Contaminated Soil
Shading = Concentration exceeds Unrestricted Use (Track 1) Soil Cleanup Objectives
Italicized = Concentration exceeds Restricted Use (Track 2) Residential Soil Cleanup Objectives

Table 5. Summary of Waste Characterization in Soil
Phase II Environmental Subsurface Investigation for the Croton Water Treatment Plant
3851 Jerome Ave., Bronx, NY

Parameter	6 NYCRR Part 371 and RCRA	Sample ID, Date Collected, and Depth (ftbg)						
		SB-01-COMP	SB-02-COMP	SB-03-COMP	SB-04-COMP	SB-05-COMP	SB-06-COMP	SB-07-COMP
		5/25/2016	5/26/2016	5/26/2016	5/26/2016	5/26/2016	5/24/2016	5/24/2016
		0.5-6	0.5-9	0.5-10	0.5-12	0.5-18	0.5-3.5	0.5-3.5
METALs[1]	ug/L							
Barium	100,000	1,660	752	563	772	827	554	547
Chromium	5,000	ND	ND	ND	13.6 J	ND	ND	ND
Selenium	1,000	ND	62.9 J	54.2 J	76.1 J	ND	52.4 J	55.5 J
MISC. PARAMETERS (units)								
Reactivity Sulfide (mg/kg)	500	ND	ND	ND	ND	ND	ND	ND
Reactivity Cyanide (mg/kg)	250	ND	ND	ND	ND	ND	ND	ND
pH (SU)	2-12.5	8.86	9.21	6.72	9.89	7.76	10.40	8.60
Ignitability	>140 °F	No	No	No	No	No	No	No
TPHC Diesel Range Organics (mg/kg)	NS	4.792	9.464	9.345	5.420	1,540 J	622.545	1,081.081
TPHC Gasoiline Range Organics (mg/kg)	NS	ND	ND	ND	ND	ND	ND	ND

Notes:
ftbg = feet below grade surface
NS = No Standard
ND = Compound not detected above method detection limit (see attached lab report for mdl's)
SU = Standard unit
J = Estimated value
mg/Kg = milligram per kilogram
ug/L = microgram per liter
°F = Degrees Fahrenheit
[1] = TCLP RCRA Metals

Shading = Concentration exceeds 6 NYCRR Part 371 and RCRA Toxicity Characteristic Regulatory Levels for Hazardous Waste.

Attachment A

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

DATA FOR

VOLATILE ORGANICS

SEMI-VOLATILE ORGANICS

GC SEMI-VOLATILES

METALS

GENERAL CHEMISTRY

PROJECT NAME : OEGS RUSH

LIRO ENGINEERS, INC.

690 Delaware Ave.

Buffalo, NY - 14209

Phone No: 716-882-5476

ORDER ID : H3316

ATTENTION : Amy Hewson

ACCREDITED IN ACCORDANCE WITH nelac

DoD ELAP

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Date : 05/31/2016

Dear Amy Hewson,

9 soil samples for the **OEGS Rush** project were received on **05/26/2016.** The analytical fax results for those samples requested for an expedited turn around time may be seen in this report. Please contact me if you have any questions or concerns regarding this report.

The invoice for this workorder is also attached to the e-mail.

Regards,

Snehal Mehta

908-728-3149

snehal@chemtech.net

CHEMTECH
CHAIN OF CUSTODY RECORD

284 Sheffield Street, Mountainside, NJ 07092
(908) 789-8900 Fax (908) 789-8922
www.chemtech.net

CHEMTECH PROJECT NO.
QUOTE NO.
COC Number 037726

CLIENT INFORMATION (REPORT TO BE,SENT TO:)

COMPANY: LiRO Engineers, Inc.
ADDRESS: 703 Lorimer Street
CITY: Brooklyn STATE: NY ZIP: 11211
ATTENTION: Steve Frank
PHONE: 716 882 9645 FAX: —

CLIENT PROJECT INFORMATION

PROJECT NAME: Croton Water Treatment Plant on Jerome Ave
PROJECT NO.: 15-008-0265 LOCATION: Bronx, NY
PROJECT MANAGER: Steve Frank
e-mail: franks@lirp.com
PHONE: 716 882-9645 FAX: —

CLIENT BILLING INFORMATION

BILL TO: PO#:
ADDRESS: same
CITY: STATE: ZIP:
ATTENTION: PHONE: same

DATA TURNAROUND INFORMATION

FAX: DAYS *
HARD COPY: 2 day TAT DAYS *
EDD: DAYS *
PREAPPROVED TAT: ☒ YES ☐ NO prices provided by Joe Bocery
* STANDARD TURNAROUND TIME IS 10 BUSINESS DAYS

DATA DELIVERABLE INFORMATION

☒ LEVEL 1: Results only ☐ Others
☐ LEVEL 2: Results + QC
☐ LEVEL 3: Results (plus results raw data) + QC
☐ LEVEL 4: Results + QC (all raw data)
☐ EDD Format:

ANALYSIS

1 TCL VOCs 8260B
2 PAHs 8270C
3 TCL PCBs 3550B/8082
4 TPHC DRO/GRO 8015
5 RCRA Parameters
6 TCLP RCRA metals
7
8
9

CHEMTECH SAMPLE ID	PROJECT SAMPLE IDENTIFICATION	SAMPLE MATRIX	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	# OF BOTTLES	PRESERVATIVES E 1	2	3	4	5	6	7	8	9	COMMENTS
1.	SB-01-5.5-6.0'	soil		X	5/25/16	1300	1	X									
2.	SB-01-COMP	soil	X		"	1300	2		X	X	X	X	X				
3.	SB-06-3.0-3.5'			X	5/24/16	1630	1	X									
4.	SB-06-COMP		X			1630	3		X	X	X	X	X				
5.	SB-07-3.0-3.5'			X		1350	1	X									
6.	SB-07-COMP		X			1350	2		X	X	X	X	X				
7.																	
8.																	
9.																	
10.																	

Specify Preservatives: A-HCl B-HNO_3 C-H_2SO_4 D-NaOH E-ICE F-Other

SAMPLE CUSTODY MUST BE DOCUMENTED BELOW EACH TIME SAMPLES CHANGE POSSESSION INCLUDING COURIER DELIVERY

	DATE/TIME		
RELINQUISHED BY SAMPLER: 1.	5/26/16 0845	RECEIVED BY: 1.	
RELINQUISHED BY: 2.	DATE/TIME:	RECEIVED BY: 2.	
RELINQUISHED BY: 3.	DATE/TIME: 1250 5-26-16	RECEIVED FOR LAB BY: 3.	

Conditions of bottles or coolers at receipt: ☐ Compliant ☐ Non Compliant Cooler Temp. 5 c
MeOH extraction requires an additional 4 oz jar for percent solid.
Comments:
Ice in Cooler?: Yes

Page ___ of ___

SHIPPED VIA: CLIENT: ☐ HAND DELIVERED ☐ OVERNIGHT CHEMTECH: ☒ PICKED UP ☐ OVERNIGHT
Shipment Complete: ☐ YES ☐ NO

Revision 8/2007

WHITE - CHEMTECH COPY FOR RETURN TO CLIENT YELLOW - CHEMTECH COPY PINK - SAMPLER COPY

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-5.5-6.0	SDG No.:	H3316
Lab Sample ID:	H3316-01	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	10.7
Sample Wt/Vol:	5 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049751.D	1		05/26/16 16:54	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.56	U	0.56	0.56	5.6	ug/Kg
74-87-3	Chloromethane	0.56	U	0.56	0.56	5.6	ug/Kg
75-01-4	Vinyl Chloride	0.56	U	0.56	0.56	5.6	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.6	ug/Kg
75-00-3	Chloroethane	0.56	U	0.56	0.56	5.6	ug/Kg
75-69-4	Trichlorofluoromethane	0.56	U	0.56	0.56	5.6	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.56	U	0.56	0.56	5.6	ug/Kg
75-65-0	Tert butyl alcohol	28	U	8.3	28	28	ug/Kg
75-35-4	1,1-Dichloroethene	0.56	U	0.56	0.56	5.6	ug/Kg
67-64-1	Acetone	2.8	U	2.8	2.8	28	ug/Kg
75-15-0	Carbon Disulfide	0.56	U	0.56	0.56	5.6	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.56	U	0.56	0.56	5.6	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.6	ug/Kg
75-09-2	Methylene Chloride	6.7		0.56	0.56	5.6	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.56	U	0.56	0.56	5.6	ug/Kg
75-34-3	1,1-Dichloroethane	0.56	U	0.56	0.56	5.6	ug/Kg
110-82-7	Cyclohexane	0.56	U	0.56	0.56	5.6	ug/Kg
78-93-3	2-Butanone	8.4	U	3.5	8.4	28	ug/Kg
56-23-5	Carbon Tetrachloride	0.56	U	0.56	0.56	5.6	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.56	U	0.56	0.56	5.6	ug/Kg
74-97-5	Bromochloromethane	0.56	U	0.56	0.56	5.6	ug/Kg
67-66-3	Chloroform	0.56	U	0.56	0.56	5.6	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.56	U	0.56	0.56	5.6	ug/Kg
108-87-2	Methylcyclohexane	0.56	U	0.56	0.56	5.6	ug/Kg
71-43-2	Benzene	0.56	U	0.43	0.56	5.6	ug/Kg
107-06-2	1,2-Dichloroethane	0.56	U	0.56	0.56	5.6	ug/Kg
79-01-6	Trichloroethene	0.56	U	0.56	0.56	5.6	ug/Kg
78-87-5	1,2-Dichloropropane	0.56	U	0.29	0.56	5.6	ug/Kg
75-27-4	Bromodichloromethane	0.56	U	0.56	0.56	5.6	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.8	U	2.8	2.8	28	ug/Kg
108-88-3	Toluene	0.56	U	0.56	0.56	5.6	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.56	U	0.56	0.56	5.6	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-5.5-6.0	SDG No.:	H3316
Lab Sample ID:	H3316-01	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	10.7
Sample Wt/Vol:	5 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049751.D	1		05/26/16 16:54	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.56	U	0.56	0.56	5.6	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	1	1.1	5.6	ug/Kg
591-78-6	2-Hexanone	2.8	U	2.8	2.8	28	ug/Kg
124-48-1	Dibromochloromethane	0.56	U	0.56	0.56	5.6	ug/Kg
106-93-4	1,2-Dibromoethane	0.56	U	0.56	0.56	5.6	ug/Kg
127-18-4	Tetrachloroethene	0.56	U	0.56	0.56	5.6	ug/Kg
108-90-7	Chlorobenzene	0.56	U	0.56	0.56	5.6	ug/Kg
100-41-4	Ethyl Benzene	0.56	U	0.56	0.56	5.6	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.81	1.1	11.2	ug/Kg
95-47-6	o-Xylene	0.56	U	0.56	0.56	5.6	ug/Kg
100-42-5	Styrene	0.56	U	0.5	0.56	5.6	ug/Kg
75-25-2	Bromoform	1.7	U	0.83	1.7	5.6	ug/Kg
98-82-8	Isopropylbenzene	0.56	U	0.54	0.56	5.6	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.56	U	0.52	0.56	5.6	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.56	U	0.41	0.56	5.6	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.56	U	0.46	0.56	5.6	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.56	U	0.56	0.56	5.6	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.6	U	0.97	5.6	5.6	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.56	U	0.56	0.56	5.6	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.56	1.1	5.6	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	50.6		56 - 120		101%	SPK: 50
1868-53-7	Dibromofluoromethane	49.6		57 - 135		99%	SPK: 50
2037-26-5	Toluene-d8	48.3		67 - 123		97%	SPK: 50
460-00-4	4-Bromofluorobenzene	50.7		33 - 141		101%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	557423	6.33				
540-36-3	1,4-Difluorobenzene	869423	7.45				
3114-55-4	Chlorobenzene-d5	884739	11.6				
3855-82-1	1,4-Dichlorobenzene-d4	406948	13.94				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-5.5-6.0	SDG No.:	H3316
Lab Sample ID:	H3316-01	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	10.7
Sample Wt/Vol:	5 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049751.D	1		05/26/16 16:54	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-02	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	8.3 Decanted:
Sample Wt/Vol:	30.04 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016591.D	1	05/27/16 08:00	05/27/16 17:30	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	4792		908	910	1820	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	14		37 - 130		70%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-02	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	8.3 Decanted:
Sample Wt/Vol:	5.04 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006745.D	1	05/31/16 14:05	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	24.5	U	13	24.5	49	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	11.4		50 - 150		57%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-02	Matrix:	SOIL
Analytical Method:	SW8082A	% Moisture:	8.3 Decanted:
Sample Wt/Vol:	30.07 Units: g	Final Vol:	10000 uL
Soil Aliquot Vol:	uL	Test:	PCB
Extraction Type:		Injection Volume :	
GPC Factor :	1.0 PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008687.D	1	05/27/16 09:10	05/31/16 12:36	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.6	U	3.6	3.6	18.5	ug/kg
11104-28-2	Aroclor-1221	3.6	U	3.6	3.6	18.5	ug/kg
11141-16-5	Aroclor-1232	3.6	U	3.6	3.6	18.5	ug/kg
53469-21-9	Aroclor-1242	3.6	U	3.6	3.6	18.5	ug/kg
12672-29-6	Aroclor-1248	3.6	U	3.6	3.6	18.5	ug/kg
11097-69-1	Aroclor-1254	3.6	U	1.6	3.6	18.5	ug/kg
37324-23-5	Aroclor-1262	3.6	U	3.6	3.6	18.5	ug/kg
11100-14-4	Aroclor-1268	3.6	U	3.6	3.6	18.5	ug/kg
11096-82-5	Aroclor-1260	3.6	U	3.6	3.6	18.5	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	18.4		10 - 166		92%	SPK: 20
2051-24-3	Decachlorobiphenyl	16		60 - 125		80%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-02	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	8.3
Sample Wt/Vol:	30.07 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087573.D	1	05/27/16 08:56	05/31/16 04:28	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	36.3	U	12.5	36.3	360	ug/Kg
208-96-8	Acenaphthylene	36.3	U	9.1	36.3	360	ug/Kg
83-32-9	Acenaphthene	36.3	U	10.2	36.3	360	ug/Kg
86-73-7	Fluorene	36.3	U	13.7	36.3	360	ug/Kg
85-01-8	Phenanthrene	36.3	U	9.8	36.3	360	ug/Kg
120-12-7	Anthracene	36.3	U	7.4	36.3	360	ug/Kg
206-44-0	Fluoranthene	36.3	U	7.3	36.3	360	ug/Kg
129-00-0	Pyrene	36.3	U	8.7	36.3	360	ug/Kg
56-55-3	Benzo(a)anthracene	36.3	U	17.3	36.3	360	ug/Kg
218-01-9	Chrysene	36.3	U	16.4	36.3	360	ug/Kg
205-99-2	Benzo(b)fluoranthene	36.3	U	11.9	36.3	360	ug/Kg
207-08-9	Benzo(k)fluoranthene	36.3	U	17.1	36.3	360	ug/Kg
50-32-8	Benzo(a)pyrene	36.3	U	7.8	36.3	360	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	36.3	U	12.1	36.3	360	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	36.3	U	10.4	36.3	360	ug/Kg
191-24-2	Benzo(g,h,i)perylene	36.3	U	14.7	36.3	360	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	61.6		31 - 132		62%	SPK: 100
321-60-8	2-Fluorobiphenyl	59.6		39 - 123		60%	SPK: 100
1718-51-0	Terphenyl-d14	50.9		37 - 115		51%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	102442	7.48				
1146-65-2	Naphthalene-d8	399078	9.52				
15067-26-2	Acenaphthene-d10	183159	12.34				
1517-22-2	Phenanthrene-d10	302958	14.77				
1719-03-5	Chrysene-d12	223794	18.49				
1520-96-3	Perylene-d12	205956	20.17				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-02	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	8.3
Sample Wt/Vol:	30.07 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087573.D	1	05/27/16 08:56	05/31/16 04:28	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-3.0-3.5	SDG No.:	H3316
Lab Sample ID:	H3316-03	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.2
Sample Wt/Vol:	4.98 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049752.D	1		05/26/16 17:22	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
74-87-3	Chloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-01-4	Vinyl Chloride	0.54	U	0.54	0.54	5.4	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.4	ug/Kg
75-00-3	Chloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-69-4	Trichlorofluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-65-0	Tert butyl alcohol	27	U	8	27	27	ug/Kg
75-35-4	1,1-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
67-64-1	Acetone	2.7	U	2.7	2.7	27	ug/Kg
75-15-0	Carbon Disulfide	0.54	U	0.54	0.54	5.4	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.54	U	0.54	0.54	5.4	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.4	ug/Kg
75-09-2	Methylene Chloride	7.7		0.54	0.54	5.4	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
75-34-3	1,1-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
110-82-7	Cyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
78-93-3	2-Butanone	8.1	U	3.4	8.1	27	ug/Kg
56-23-5	Carbon Tetrachloride	0.54	U	0.54	0.54	5.4	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
74-97-5	Bromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
67-66-3	Chloroform	0.54	U	0.54	0.54	5.4	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-87-2	Methylcyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
71-43-2	Benzene	0.54	U	0.41	0.54	5.4	ug/Kg
107-06-2	1,2-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
79-01-6	Trichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
78-87-5	1,2-Dichloropropane	0.54	U	0.28	0.54	5.4	ug/Kg
75-27-4	Bromodichloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.7	U	2.7	2.7	27	ug/Kg
108-88-3	Toluene	0.54	U	0.54	0.54	5.4	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-3.0-3.5	SDG No.:	H3316
Lab Sample ID:	H3316-03	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.2
Sample Wt/Vol:	4.98 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049752.D	1		05/26/16 17:22	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.97	1.1	5.4	ug/Kg
591-78-6	2-Hexanone	2.7	U	2.7	2.7	27	ug/Kg
124-48-1	Dibromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
106-93-4	1,2-Dibromoethane	0.54	U	0.54	0.54	5.4	ug/Kg
127-18-4	Tetrachloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
108-90-7	Chlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
100-41-4	Ethyl Benzene	0.54	U	0.54	0.54	5.4	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.78	1.1	10.8	ug/Kg
95-47-6	o-Xylene	0.54	U	0.54	0.54	5.4	ug/Kg
100-42-5	Styrene	0.54	U	0.49	0.54	5.4	ug/Kg
75-25-2	Bromoform	1.6	U	0.8	1.6	5.4	ug/Kg
98-82-8	Isopropylbenzene	0.54	U	0.52	0.54	5.4	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.54	U	0.5	0.54	5.4	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.54	U	0.4	0.54	5.4	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.54	U	0.44	0.54	5.4	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.4	U	0.94	5.4	5.4	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.54	1.1	5.4	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	62.6	*	56 - 120		125%	SPK: 50
1868-53-7	Dibromofluoromethane	50.5		57 - 135		101%	SPK: 50
2037-26-5	Toluene-d8	40.3		67 - 123		81%	SPK: 50
460-00-4	4-Bromofluorobenzene	27.5		33 - 141		55%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	370567	6.33				
540-36-3	1,4-Difluorobenzene	629896	7.46				
3114-55-4	Chlorobenzene-d5	496174	11.6				
3855-82-1	1,4-Dichlorobenzene-d4	128440	13.94				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-3.0-3.5	SDG No.:	H3316
Lab Sample ID:	H3316-03	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.2
Sample Wt/Vol:	4.98 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049752.D	1		05/26/16 17:22	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-3.0-3.5RE	SDG No.:	H3316
Lab Sample ID:	H3316-03RE	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.2
Sample Wt/Vol:	4.98 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049767.D	1		05/27/16 13:02	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
74-87-3	Chloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-01-4	Vinyl Chloride	0.54	U	0.54	0.54	5.4	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.4	ug/Kg
75-00-3	Chloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-69-4	Trichlorofluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-65-0	Tert butyl alcohol	27	U	8	27	27	ug/Kg
75-35-4	1,1-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
67-64-1	Acetone	2.7	U	2.7	2.7	27	ug/Kg
75-15-0	Carbon Disulfide	0.54	U	0.54	0.54	5.4	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.54	U	0.54	0.54	5.4	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.4	ug/Kg
75-09-2	Methylene Chloride	10.7		0.54	0.54	5.4	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
75-34-3	1,1-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
110-82-7	Cyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
78-93-3	2-Butanone	8.1	U	3.4	8.1	27	ug/Kg
56-23-5	Carbon Tetrachloride	0.54	U	0.54	0.54	5.4	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
74-97-5	Bromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
67-66-3	Chloroform	0.54	U	0.54	0.54	5.4	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-87-2	Methylcyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
71-43-2	Benzene	0.54	U	0.41	0.54	5.4	ug/Kg
107-06-2	1,2-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
79-01-6	Trichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
78-87-5	1,2-Dichloropropane	0.54	U	0.28	0.54	5.4	ug/Kg
75-27-4	Bromodichloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.7	U	2.7	2.7	27	ug/Kg
108-88-3	Toluene	0.54	U	0.54	0.54	5.4	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-3.0-3.5RE	SDG No.:	H3316
Lab Sample ID:	H3316-03RE	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.2
Sample Wt/Vol:	4.98 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049767.D	1		05/27/16 13:02	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.97	1.1	5.4	ug/Kg
591-78-6	2-Hexanone	2.7	U	2.7	2.7	27	ug/Kg
124-48-1	Dibromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
106-93-4	1,2-Dibromoethane	0.54	U	0.54	0.54	5.4	ug/Kg
127-18-4	Tetrachloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
108-90-7	Chlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
100-41-4	Ethyl Benzene	0.54	U	0.54	0.54	5.4	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.78	1.1	10.8	ug/Kg
95-47-6	o-Xylene	0.54	U	0.54	0.54	5.4	ug/Kg
100-42-5	Styrene	0.54	U	0.49	0.54	5.4	ug/Kg
75-25-2	Bromoform	1.6	U	0.8	1.6	5.4	ug/Kg
98-82-8	Isopropylbenzene	0.54	U	0.52	0.54	5.4	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.54	U	0.5	0.54	5.4	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.54	U	0.4	0.54	5.4	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.54	U	0.44	0.54	5.4	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.4	U	0.94	5.4	5.4	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.54	1.1	5.4	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	47.7		56 - 120		95%	SPK: 50
1868-53-7	Dibromofluoromethane	47.9		57 - 135		96%	SPK: 50
2037-26-5	Toluene-d8	39.4		67 - 123		79%	SPK: 50
460-00-4	4-Bromofluorobenzene	24.5		33 - 141		49%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	470671	6.32				
540-36-3	1,4-Difluorobenzene	751767	7.46				
3114-55-4	Chlorobenzene-d5	559931	11.6				
3855-82-1	1,4-Dichlorobenzene-d4	142113	13.94				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-3.0-3.5RE	SDG No.:	H3316
Lab Sample ID:	H3316-03RE	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.2
Sample Wt/Vol:	4.98 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049767.D	1		05/27/16 13:02	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-04	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	8.3 Decanted:
Sample Wt/Vol:	1.03 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016594.D	1	05/27/16 08:00	05/27/16 19:17	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	622545		26500	26500	52900	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	14.1		37 - 130		70%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-04	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	8.3 Decanted:
Sample Wt/Vol:	5.01 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006746.D	1	05/31/16 14:38	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	24.5	U	13	24.5	49	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	11.5		50 - 150		57%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-04	Matrix:	SOIL
Analytical Method:	SW8082A	% Moisture:	8.3 Decanted:
Sample Wt/Vol:	30.04 Units: g	Final Vol:	10000 uL
Soil Aliquot Vol:	uL	Test:	PCB
Extraction Type:		Injection Volume :	
GPC Factor :	1.0 PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008688.D	1	05/27/16 09:10	05/31/16 12:50	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.6	U	3.6	3.6	18.5	ug/kg
11104-28-2	Aroclor-1221	3.6	U	3.6	3.6	18.5	ug/kg
11141-16-5	Aroclor-1232	3.6	U	3.6	3.6	18.5	ug/kg
53469-21-9	Aroclor-1242	3.6	U	3.6	3.6	18.5	ug/kg
12672-29-6	Aroclor-1248	3.6	U	3.6	3.6	18.5	ug/kg
11097-69-1	Aroclor-1254	3.6	U	1.6	3.6	18.5	ug/kg
37324-23-5	Aroclor-1262	3.6	U	3.6	3.6	18.5	ug/kg
11100-14-4	Aroclor-1268	3.6	U	3.6	3.6	18.5	ug/kg
11096-82-5	Aroclor-1260	3.6	U	3.6	3.6	18.5	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	13.8		10 - 166		69%	SPK: 20
2051-24-3	Decachlorobiphenyl	14.4		60 - 125		72%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-04	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	8.3
Sample Wt/Vol:	1.05 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087574.D	1	05/27/16 08:56	05/31/16 05:03	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	1000	U	360	1000	10300	ug/Kg
208-96-8	Acenaphthylene	1000	U	260	1000	10300	ug/Kg
83-32-9	Acenaphthene	1000	U	290	1000	10300	ug/Kg
86-73-7	Fluorene	1000	U	390	1000	10300	ug/Kg
85-01-8	Phenanthrene	1000	U	280	1000	10300	ug/Kg
120-12-7	Anthracene	1000	U	210	1000	10300	ug/Kg
206-44-0	Fluoranthene	1000	U	210	1000	10300	ug/Kg
129-00-0	Pyrene	1000	U	250	1000	10300	ug/Kg
56-55-3	Benzo(a)anthracene	1000	U	500	1000	10300	ug/Kg
218-01-9	Chrysene	1000	U	470	1000	10300	ug/Kg
205-99-2	Benzo(b)fluoranthene	1000	U	340	1000	10300	ug/Kg
207-08-9	Benzo(k)fluoranthene	1000	U	490	1000	10300	ug/Kg
50-32-8	Benzo(a)pyrene	1000	U	220	1000	10300	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	1000	U	350	1000	10300	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	1000	U	300	1000	10300	ug/Kg
191-24-2	Benzo(g,h,i)perylene	1000	U	420	1000	10300	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	62.8		31 - 132		63%	SPK: 100
321-60-8	2-Fluorobiphenyl	68.3		39 - 123		68%	SPK: 100
1718-51-0	Terphenyl-d14	54.4		37 - 115		54%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	124165	7.47				
1146-65-2	Naphthalene-d8	479257	9.51				
15067-26-2	Acenaphthene-d10	203553	12.33				
1517-22-2	Phenanthrene-d10	310041	14.75				
1719-03-5	Chrysene-d12	263827	18.47				
1520-96-3	Perylene-d12	200872	20.16				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-04	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	8.3
Sample Wt/Vol:	1.05 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087574.D	1	05/27/16 08:56	05/31/16 05:03	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-3.0-3.5	SDG No.:	H3316
Lab Sample ID:	H3316-05	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.1
Sample Wt/Vol:	5.02 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049753.D	1		05/26/16 17:50	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
74-87-3	Chloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-01-4	Vinyl Chloride	0.54	U	0.54	0.54	5.4	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.4	ug/Kg
75-00-3	Chloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-69-4	Trichlorofluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-65-0	Tert butyl alcohol	26.8	U	7.9	26.8	26.8	ug/Kg
75-35-4	1,1-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
67-64-1	Acetone	61.9		2.7	2.7	26.8	ug/Kg
75-15-0	Carbon Disulfide	0.54	U	0.54	0.54	5.4	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.54	U	0.54	0.54	5.4	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.4	ug/Kg
75-09-2	Methylene Chloride	5	J	0.54	0.54	5.4	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
75-34-3	1,1-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
110-82-7	Cyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
78-93-3	2-Butanone	8	U	3.3	8	26.8	ug/Kg
56-23-5	Carbon Tetrachloride	0.54	U	0.54	0.54	5.4	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
74-97-5	Bromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
67-66-3	Chloroform	0.54	U	0.54	0.54	5.4	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-87-2	Methylcyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
71-43-2	Benzene	0.54	U	0.41	0.54	5.4	ug/Kg
107-06-2	1,2-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
79-01-6	Trichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
78-87-5	1,2-Dichloropropane	0.54	U	0.28	0.54	5.4	ug/Kg
75-27-4	Bromodichloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.7	U	2.7	2.7	26.8	ug/Kg
108-88-3	Toluene	0.54	U	0.54	0.54	5.4	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-3.0-3.5	SDG No.:	H3316
Lab Sample ID:	H3316-05	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.1
Sample Wt/Vol:	5.02 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049753.D	1		05/26/16 17:50	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.96	1.1	5.4	ug/Kg
591-78-6	2-Hexanone	2.7	U	2.7	2.7	26.8	ug/Kg
124-48-1	Dibromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
106-93-4	1,2-Dibromoethane	0.54	U	0.54	0.54	5.4	ug/Kg
127-18-4	Tetrachloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
108-90-7	Chlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
100-41-4	Ethyl Benzene	0.54	U	0.54	0.54	5.4	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.77	1.1	10.7	ug/Kg
95-47-6	o-Xylene	0.54	U	0.54	0.54	5.4	ug/Kg
100-42-5	Styrene	0.54	U	0.48	0.54	5.4	ug/Kg
75-25-2	Bromoform	1.6	U	0.79	1.6	5.4	ug/Kg
98-82-8	Isopropylbenzene	0.54	U	0.51	0.54	5.4	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.54	U	0.49	0.54	5.4	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.54	U	0.4	0.54	5.4	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.54	U	0.44	0.54	5.4	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.4	U	0.93	5.4	5.4	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.54	1.1	5.4	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	54		56 - 120		108%	SPK: 50
1868-53-7	Dibromofluoromethane	52.9		57 - 135		106%	SPK: 50
2037-26-5	Toluene-d8	46.9		67 - 123		94%	SPK: 50
460-00-4	4-Bromofluorobenzene	44		33 - 141		88%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	517802	6.34				
540-36-3	1,4-Difluorobenzene	821964	7.46				
3114-55-4	Chlorobenzene-d5	783896	11.59				
3855-82-1	1,4-Dichlorobenzene-d4	287579	13.93				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-3.0-3.5	SDG No.:	H3316
Lab Sample ID:	H3316-05	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.1
Sample Wt/Vol:	5.02 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049753.D	1		05/26/16 17:50	VD052616

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-06	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	7.5 Decanted:
Sample Wt/Vol:	1.09 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016597.D	5	05/27/16 08:00	05/27/16 21:04	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	1081081		124000	124000	248000	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	2.82		37 - 130		70%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-06	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	7.5 Decanted:
Sample Wt/Vol:	5.04 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006744.D	1	05/31/16 13:22	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	24	U	13	24	48	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	12.1		50 - 150		61%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-06	Matrix:	SOIL
Analytical Method:	SW8082A	% Moisture:	7.5 Decanted:
Sample Wt/Vol:	30.07 Units: g	Final Vol:	10000 uL
Soil Aliquot Vol:	uL	Test:	PCB
Extraction Type:		Injection Volume :	
GPC Factor :	1.0 PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008689.D	1	05/27/16 09:10	05/31/16 13:05	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.6	U	3.6	3.6	18.3	ug/kg
11104-28-2	Aroclor-1221	3.6	U	3.6	3.6	18.3	ug/kg
11141-16-5	Aroclor-1232	3.6	U	3.6	3.6	18.3	ug/kg
53469-21-9	Aroclor-1242	3.6	U	3.6	3.6	18.3	ug/kg
12672-29-6	Aroclor-1248	3.6	U	3.6	3.6	18.3	ug/kg
11097-69-1	Aroclor-1254	3.6	U	1.6	3.6	18.3	ug/kg
37324-23-5	Aroclor-1262	3.6	U	3.6	3.6	18.3	ug/kg
11100-14-4	Aroclor-1268	3.6	U	3.6	3.6	18.3	ug/kg
11096-82-5	Aroclor-1260	3.6	U	3.6	3.6	18.3	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	13.8		10 - 166		69%	SPK: 20
2051-24-3	Decachlorobiphenyl	14.6		60 - 125		73%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-06	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	7.5
Sample Wt/Vol:	1.03 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087575.D	1	05/27/16 08:56	05/31/16 05:37	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	1000	U	360	1000	10400	ug/Kg
208-96-8	Acenaphthylene	1000	U	260	1000	10400	ug/Kg
83-32-9	Acenaphthene	1000	U	300	1000	10400	ug/Kg
86-73-7	Fluorene	1000	U	400	1000	10400	ug/Kg
85-01-8	Phenanthrene	1000	U	280	1000	10400	ug/Kg
120-12-7	Anthracene	1000	U	210	1000	10400	ug/Kg
206-44-0	Fluoranthene	1000	U	210	1000	10400	ug/Kg
129-00-0	Pyrene	1000	U	250	1000	10400	ug/Kg
56-55-3	Benzo(a)anthracene	1000	U	500	1000	10400	ug/Kg
218-01-9	Chrysene	1000	U	480	1000	10400	ug/Kg
205-99-2	Benzo(b)fluoranthene	1000	U	340	1000	10400	ug/Kg
207-08-9	Benzo(k)fluoranthene	1000	U	490	1000	10400	ug/Kg
50-32-8	Benzo(a)pyrene	1000	U	230	1000	10400	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	1000	U	350	1000	10400	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	1000	U	300	1000	10400	ug/Kg
191-24-2	Benzo(g,h,i)perylene	1000	U	430	1000	10400	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	69		31 - 132		69%	SPK: 100
321-60-8	2-Fluorobiphenyl	75.1		39 - 123		75%	SPK: 100
1718-51-0	Terphenyl-d14	64.8		37 - 115		65%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	111884	7.47				
1146-65-2	Naphthalene-d8	457195	9.51				
15067-26-2	Acenaphthene-d10	197242	12.33				
1517-22-2	Phenanthrene-d10	323399	14.74				
1719-03-5	Chrysene-d12	237785	18.47				
1520-96-3	Perylene-d12	190575	20.16				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-06	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	7.5
Sample Wt/Vol:	1.03 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup : N	PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087575.D	1	05/27/16 08:56	05/31/16 05:37	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16 13:00
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-07	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	8.86		1	0	0	0	pH		05/26/16 15:22	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:45	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/25/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-01-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-07	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010
7440-39-3	Barium	1660		1	40	125	500	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010
7440-47-3	Chromium	12.5	U	1	11	12.5	50	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/27/16 09:57	05/27/16 15:47	SW7470A
7782-49-2	Selenium	50	U	1	48	50.0	100	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/27/16 13:00	05/27/16 15:51	SW6010

Color Before:	Black	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16 16:30
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-08	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	10.4		1	0	0	0	pH		05/26/16 15:23	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:45	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-06-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-08	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010
7440-39-3	Barium	554		1	40	125	500	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010
7440-47-3	Chromium	12.5	U	1	11	12.5	50	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/27/16 09:57	05/27/16 16:00	SW7470A
7782-49-2	Selenium	52.4	J	1	48	50.0	100	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/27/16 13:00	05/27/16 16:37	SW6010

Color Before:	Black	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16 13:50
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-09	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	8.6		1	0	0	0	pH		05/26/16 15:24	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:45	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/24/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-07-COMP	SDG No.:	H3316
Lab Sample ID:	H3316-09	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010
7440-39-3	Barium	547		1	40	125	500	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010
7440-47-3	Chromium	12.5	U	1	11	12.5	50	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/27/16 09:57	05/27/16 16:02	SW7470A
7782-49-2	Selenium	55.5	J	1	48	50.0	100	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/27/16 13:00	05/27/16 16:41	SW6010

Color Before:	Black	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

DATA FOR

VOLATILE ORGANICS

SEMI-VOLATILE ORGANICS

GC SEMI-VOLATILES

METALS

GENERAL CHEMISTRY

PROJECT NAME : OEGS RUSH

LIRO ENGINEERS, INC.

690 Delaware Ave.

Buffalo, NY - 14209

Phone No: 716-882-5476

ORDER ID : H3323

ATTENTION : Amy Hewson

ACCREDITED IN ACCORDANCE WITH nelac

DoD ELAP

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Date : 06/01/2016

Dear Amy Hewson,

12 soil samples for the **OEGS Rush** project were received on **05/26/2016.** The analytical fax results for those samples requested for an expedited turn around time may be seen in this report. Please contact me if you have any questions or concerns regarding this report.

The invoice for this workorder is also attached to the e-mail.

Regards,

Snehal Mehta

908-728-3149

snehal@chemtech.net

CHEMTECH
CHAIN OF CUSTODY RECORD

284 Sheffield Street, Mountainside, NJ 07092
(908) 789-8900 Fax (908) 789-8922
www.chemtech.net

CHEMTECH PROJECT NO. H3323
QUOTE NO.
COC Number 034328

CLIENT INFORMATION
REPORT TO BE SENT TO:
COMPANY: LiRo Engineers, Inc.
ADDRESS: 703 Corimer Street
CITY: Brooklyn STATE: NY ZIP: 11211
ATTENTION: Steve Frank
PHONE: 716 882-9645 FAX: —

CLIENT PROJECT INFORMATION
PROJECT NAME: Croton Water Treatment Plant, Jerome Ave
PROJECT NO.: 15-008-026 LOCATION: Bronx, NY
PROJECT MANAGER: Steve Frank
e-mail: franks@lir.com
PHONE: 716-882-9645 FAX: —

CLIENT BILLING INFORMATION
BILL TO: PO#:
ADDRESS:
CITY: Same STATE: ZIP:
ATTENTION: PHONE:

DATA TURNAROUND INFORMATION
FAX: DAYS *
HARD COPY: 48hr. TAT DAYS *
EDD: DAYS *
PREAPPROVED TAT: ☒ YES ☐ NO Joe Dockery prices
* STANDARD TURNAROUND TIME IS 10 BUSINESS DAYS

DATA DELIVERABLE INFORMATION
☒ LEVEL 1: Results only ☐ Others
☐ LEVEL 2: Results + QC
☐ LEVEL 3: Results (plus results raw data) + QC
☐ LEVEL 4: Results + QC (all raw data)
☐ EDD Format:

ANALYSIS
1 TCL VOCs 8260B
2 PAHs 8270C
3 TCL PCBs 3550B/8082
4 TPHC DRO/GRO
5 RCRA Parameters
6 TCLP RCRA metals
7
8
9

CHEMTECH SAMPLE ID	PROJECT SAMPLE IDENTIFICATION	SAMPLE MATRIX	SAMPLE TYPE COMP	SAMPLE TYPE GRAB	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	# OF BOTTLES	PRESERVATIVES E	1	2	3	4	5	6	7	8	9	COMMENTS
1.	SB-02-8.5-9	soil		X	5/26/16	11:40	1		X									
2.	SB-02-comp	soil	X			↓	2			X	X	X	X	X				
3.	SB-03-9.5-10			X		12:20	1		X									
4.	SB-03-comp		X			↓	2			X	X	X	X	X				
5.	SB-04-11.5-12			X		12:30	1		X									
6.	SB-04-comp		X			↓	2			X	X	X	X	X				
7.	SB-05-17.5-18			X		11:55	1		X									
8.	SB-05-comp	↓	X		↓	↓	2			X	X	X	X	X				
9.																		
10.																		

← Specify Preservatives
A-HCl B-HNO_3 C-H_2SO_4 D-NaOH E-ICE F-Other

SAMPLE CUSTODY MUST BE DOCUMENTED BELOW EACH TIME SAMPLES CHANGE POSSESSION INCLUDING COURIER DELIVERY

RELINQUISHED BY SAMPLER: 1.	DATE/TIME: 1630 5-26-16	RECEIVED BY: 1.
RELINQUISHED BY: 2.	DATE/TIME:	RECEIVED BY: 2.
RELINQUISHED BY: 3.	DATE/TIME: 1850 5-26-16	RECEIVED FOR LAB BY: 3.

Conditions of bottles or coolers at receipt: ☒ Compliant ☐ Non Compliant Cooler Temp. 5°c
MeOH extraction requires an additional 4 oz jar for percent solid.
Comments: Ice in Cooler?: Yes

Page 1 of 1

SHIPPED VIA: CLIENT: ☐ HAND DELIVERED ☐ OVERNIGHT CHEMTECH: ☒ PICKED UP ☐ OVERNIGHT
Shipment Complete: ☒ YES ☐ NO

Revision 8/2007

WHITE - CHEMTECH COPY FOR RETURN TO CLIENT YELLOW - CHEMTECH COPY PINK - SAMPLER COPY

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-8.5-9	SDG No.:	H3323
Lab Sample ID:	H3323-01	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.3
Sample Wt/Vol:	5.01 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049771.D	1		05/27/16 14:51	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
74-87-3	Chloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-01-4	Vinyl Chloride	0.54	U	0.54	0.54	5.4	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.4	ug/Kg
75-00-3	Chloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-69-4	Trichlorofluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-65-0	Tert butyl alcohol	26.9	U	8	26.9	26.9	ug/Kg
75-35-4	1,1-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
67-64-1	Acetone	2.7	U	2.7	2.7	26.9	ug/Kg
75-15-0	Carbon Disulfide	0.54	U	0.54	0.54	5.4	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.54	U	0.54	0.54	5.4	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.4	ug/Kg
75-09-2	Methylene Chloride	3.8	J	0.54	0.54	5.4	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
75-34-3	1,1-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
110-82-7	Cyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
78-93-3	2-Butanone	8.1	U	3.3	8.1	26.9	ug/Kg
56-23-5	Carbon Tetrachloride	0.54	U	0.54	0.54	5.4	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
74-97-5	Bromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
67-66-3	Chloroform	0.54	U	0.54	0.54	5.4	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-87-2	Methylcyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
71-43-2	Benzene	0.54	U	0.41	0.54	5.4	ug/Kg
107-06-2	1,2-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
79-01-6	Trichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
78-87-5	1,2-Dichloropropane	0.54	U	0.28	0.54	5.4	ug/Kg
75-27-4	Bromodichloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.7	U	2.7	2.7	26.9	ug/Kg
108-88-3	Toluene	0.54	U	0.54	0.54	5.4	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-8.5-9	SDG No.:	H3323
Lab Sample ID:	H3323-01	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.3
Sample Wt/Vol:	5.01 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049771.D	1		05/27/16 14:51	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.97	1.1	5.4	ug/Kg
591-78-6	2-Hexanone	2.7	U	2.7	2.7	26.9	ug/Kg
124-48-1	Dibromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
106-93-4	1,2-Dibromoethane	0.54	U	0.54	0.54	5.4	ug/Kg
127-18-4	Tetrachloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
108-90-7	Chlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
100-41-4	Ethyl Benzene	0.54	U	0.54	0.54	5.4	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.78	1.1	10.8	ug/Kg
95-47-6	o-Xylene	0.54	U	0.54	0.54	5.4	ug/Kg
100-42-5	Styrene	0.54	U	0.48	0.54	5.4	ug/Kg
75-25-2	Bromoform	1.6	U	0.8	1.6	5.4	ug/Kg
98-82-8	Isopropylbenzene	0.54	U	0.52	0.54	5.4	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.54	U	0.5	0.54	5.4	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.54	U	0.4	0.54	5.4	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.54	U	0.44	0.54	5.4	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.4	U	0.94	5.4	5.4	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	1.1	J	0.54	0.54	5.4	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.54	1.1	5.4	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	46.7		56 - 120		93%	SPK: 50
1868-53-7	Dibromofluoromethane	48.7		57 - 135		97%	SPK: 50
2037-26-5	Toluene-d8	47.1		67 - 123		94%	SPK: 50
460-00-4	4-Bromofluorobenzene	52.5		33 - 141		105%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	536238	6.33				
540-36-3	1,4-Difluorobenzene	809337	7.46				
3114-55-4	Chlorobenzene-d5	863817	11.59				
3855-82-1	1,4-Dichlorobenzene-d4	457817	13.93				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-8.5-9	SDG No.:	H3323
Lab Sample ID:	H3323-01	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.3
Sample Wt/Vol:	5.01 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049771.D	1		05/27/16 14:51	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-02	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	8 Decanted:
Sample Wt/Vol:	30.09 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016598.D	1	05/27/16 08:00	05/27/16 21:39	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	9464		903	905	1810	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	11.8		37 - 130		59%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-02	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	8 Decanted:
Sample Wt/Vol:	5.03 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006753.D	1	05/31/16 19:30	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	24.5	U	13	24.5	49	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	18.6		50 - 150		93%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 11:40
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-02	Matrix:	SOIL
		% Solid:	92

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Paint Filter	1.09	U	1	1.09	1.09	1.09	ml/100gm		05/27/16 10:15	9095A

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-02	Matrix:	SOIL
Analytical Method:	SW8082A	% Moisture:	8 Decanted:
Sample Wt/Vol:	30.05 Units: g	Final Vol:	10000 uL
Soil Aliquot Vol:	uL	Test:	PCB
Extraction Type:		Injection Volume :	
GPC Factor :	1.0 PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008735.D	1	05/27/16 09:10	06/01/16 13:59	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.6	U	3.6	3.6	18.4	ug/kg
11104-28-2	Aroclor-1221	3.6	U	3.6	3.6	18.4	ug/kg
11141-16-5	Aroclor-1232	3.6	U	3.6	3.6	18.4	ug/kg
53469-21-9	Aroclor-1242	3.6	U	3.6	3.6	18.4	ug/kg
12672-29-6	Aroclor-1248	3.6	U	3.6	3.6	18.4	ug/kg
11097-69-1	Aroclor-1254	3.6	U	1.6	3.6	18.4	ug/kg
37324-23-5	Aroclor-1262	3.6	U	3.6	3.6	18.4	ug/kg
11100-14-4	Aroclor-1268	3.6	U	3.6	3.6	18.4	ug/kg
11096-82-5	Aroclor-1260	3.6	U	3.6	3.6	18.4	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	16		10 - 166		80%	SPK: 20
2051-24-3	Decachlorobiphenyl	16.1		60 - 125		81%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-02	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	8
Sample Wt/Vol:	30.07 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087607.D	1	05/27/16 08:56	06/01/16 06:02	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	36.1	U	12.5	36.1	360	ug/Kg
208-96-8	Acenaphthylene	36.1	U	9.1	36.1	360	ug/Kg
83-32-9	Acenaphthene	36.1	U	10.2	36.1	360	ug/Kg
86-73-7	Fluorene	36.1	U	13.7	36.1	360	ug/Kg
85-01-8	Phenanthrene	230	J	9.8	36.1	360	ug/Kg
120-12-7	Anthracene	36.1	U	7.4	36.1	360	ug/Kg
206-44-0	Fluoranthene	330	J	7.3	36.1	360	ug/Kg
129-00-0	Pyrene	330	J	8.7	36.1	360	ug/Kg
56-55-3	Benzo(a)anthracene	150	J	17.2	36.1	360	ug/Kg
218-01-9	Chrysene	200	J	16.4	36.1	360	ug/Kg
205-99-2	Benzo(b)fluoranthene	230	J	11.8	36.1	360	ug/Kg
207-08-9	Benzo(k)fluoranthene	120	J	17	36.1	360	ug/Kg
50-32-8	Benzo(a)pyrene	180	J	7.8	36.1	360	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	100	J	12	36.1	360	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	36.1	U	10.4	36.1	360	ug/Kg
191-24-2	Benzo(g,h,i)perylene	120	J	14.6	36.1	360	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	65.6		31 - 132		66%	SPK: 100
321-60-8	2-Fluorobiphenyl	71		39 - 123		71%	SPK: 100
1718-51-0	Terphenyl-d14	59.5		37 - 115		60%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	123778	7.45				
1146-65-2	Naphthalene-d8	511810	9.48				
15067-26-2	Acenaphthene-d10	215385	12.3				
1517-22-2	Phenanthrene-d10	340598	14.71				
1719-03-5	Chrysene-d12	261454	18.42				
1520-96-3	Perylene-d12	215411	20.11				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-02	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	8
Sample Wt/Vol:	30.07 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087607.D	1	05/27/16 08:56	06/01/16 06:02	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-9.5-10	SDG No.:	H3323
Lab Sample ID:	H3323-03	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.7
Sample Wt/Vol:	4.99 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049772.D	1		05/27/16 15:18	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
74-87-3	Chloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-01-4	Vinyl Chloride	0.54	U	0.54	0.54	5.4	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.4	ug/Kg
75-00-3	Chloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-69-4	Trichlorofluoromethane	0.54	U	0.54	0.54	5.4	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.54	U	0.54	0.54	5.4	ug/Kg
75-65-0	Tert butyl alcohol	27.1	U	8	27.1	27.1	ug/Kg
75-35-4	1,1-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
67-64-1	Acetone	2.7	U	2.7	2.7	27.1	ug/Kg
75-15-0	Carbon Disulfide	0.54	U	0.54	0.54	5.4	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.54	U	0.54	0.54	5.4	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.4	ug/Kg
75-09-2	Methylene Chloride	4.7	J	0.54	0.54	5.4	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
75-34-3	1,1-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
110-82-7	Cyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
78-93-3	2-Butanone	8.1	U	3.4	8.1	27.1	ug/Kg
56-23-5	Carbon Tetrachloride	0.54	U	0.54	0.54	5.4	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
74-97-5	Bromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
67-66-3	Chloroform	0.54	U	0.54	0.54	5.4	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-87-2	Methylcyclohexane	0.54	U	0.54	0.54	5.4	ug/Kg
71-43-2	Benzene	0.54	U	0.41	0.54	5.4	ug/Kg
107-06-2	1,2-Dichloroethane	0.54	U	0.54	0.54	5.4	ug/Kg
79-01-6	Trichloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
78-87-5	1,2-Dichloropropane	0.54	U	0.28	0.54	5.4	ug/Kg
75-27-4	Bromodichloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.7	U	2.7	2.7	27.1	ug/Kg
108-88-3	Toluene	0.54	U	0.54	0.54	5.4	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-9.5-10	SDG No.:	H3323
Lab Sample ID:	H3323-03	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.7
Sample Wt/Vol:	4.99 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049772.D	1		05/27/16 15:18	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.54	U	0.54	0.54	5.4	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.98	1.1	5.4	ug/Kg
591-78-6	2-Hexanone	2.7	U	2.7	2.7	27.1	ug/Kg
124-48-1	Dibromochloromethane	0.54	U	0.54	0.54	5.4	ug/Kg
106-93-4	1,2-Dibromoethane	0.54	U	0.54	0.54	5.4	ug/Kg
127-18-4	Tetrachloroethene	0.54	U	0.54	0.54	5.4	ug/Kg
108-90-7	Chlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
100-41-4	Ethyl Benzene	0.54	U	0.54	0.54	5.4	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.78	1.1	10.9	ug/Kg
95-47-6	o-Xylene	0.54	U	0.54	0.54	5.4	ug/Kg
100-42-5	Styrene	0.54	U	0.49	0.54	5.4	ug/Kg
75-25-2	Bromoform	1.6	U	0.8	1.6	5.4	ug/Kg
98-82-8	Isopropylbenzene	0.54	U	0.52	0.54	5.4	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.54	U	0.5	0.54	5.4	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.54	U	0.4	0.54	5.4	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.54	U	0.45	0.54	5.4	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.4	U	0.94	5.4	5.4	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.54	U	0.54	0.54	5.4	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.54	1.1	5.4	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	47.7		56 - 120		95%	SPK: 50
1868-53-7	Dibromofluoromethane	48.2		57 - 135		96%	SPK: 50
2037-26-5	Toluene-d8	46.5		67 - 123		93%	SPK: 50
460-00-4	4-Bromofluorobenzene	52.1		33 - 141		104%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	497204	6.33				
540-36-3	1,4-Difluorobenzene	766268	7.45				
3114-55-4	Chlorobenzene-d5	824864	11.6				
3855-82-1	1,4-Dichlorobenzene-d4	421292	13.94				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-9.5-10	SDG No.:	H3323
Lab Sample ID:	H3323-03	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	7.7
Sample Wt/Vol:	4.99 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049772.D	1		05/27/16 15:18	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-04	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	11 Decanted:
Sample Wt/Vol:	30.06 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016599.D	1	05/27/16 08:00	05/27/16 22:14	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	9345		934	935	1870	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	17.7		37 - 130		89%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-04	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	11 Decanted:
Sample Wt/Vol:	5.03 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006754.D	1	05/31/16 20:02	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	25	U	13	25	50	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	17.1		50 - 150		85%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 12:00
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-04	Matrix:	SOIL
		% Solid:	89

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Paint Filter	1.12	U	1	1.12	1.12	1.12	ml/100gm		05/27/16 10:15	9095A

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.		Date Collected:	05/26/16	
Project:	OEGS Rush		Date Received:	05/26/16	
Client Sample ID:	SB-03-COMP		SDG No.:	H3323	
Lab Sample ID:	H3323-04		Matrix:	SOIL	
Analytical Method:	SW8082A		% Moisture:	11	Decanted:
Sample Wt/Vol:	30.02	Units: g	Final Vol:	10000	uL
Soil Aliquot Vol:		uL	Test:	PCB	
Extraction Type:			Injection Volume :		
GPC Factor :	1.0	PH :			

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008716.D	1	05/27/16 09:10	05/31/16 22:49	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.7	U	3.7	3.7	19.1	ug/kg
11104-28-2	Aroclor-1221	3.7	U	3.7	3.7	19.1	ug/kg
11141-16-5	Aroclor-1232	3.7	U	3.7	3.7	19.1	ug/kg
53469-21-9	Aroclor-1242	3.7	U	3.7	3.7	19.1	ug/kg
12672-29-6	Aroclor-1248	3.7	U	3.7	3.7	19.1	ug/kg
11097-69-1	Aroclor-1254	3.7	U	1.7	3.7	19.1	ug/kg
37324-23-5	Aroclor-1262	3.7	U	3.7	3.7	19.1	ug/kg
11100-14-4	Aroclor-1268	3.7	U	3.7	3.7	19.1	ug/kg
11096-82-5	Aroclor-1260	3.7	U	3.7	3.7	19.1	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	17.4		10 - 166		87%	SPK: 20
2051-24-3	Decachlorobiphenyl	17.4		60 - 125		87%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-04	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	11
Sample Wt/Vol:	30.02 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087579.D	1	05/27/16 08:56	05/31/16 07:54	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	37.4	U	12.9	37.4	370	ug/Kg
208-96-8	Acenaphthylene	37.4	U	9.4	37.4	370	ug/Kg
83-32-9	Acenaphthene	37.4	U	10.6	37.4	370	ug/Kg
86-73-7	Fluorene	37.4	U	14.1	37.4	370	ug/Kg
85-01-8	Phenanthrene	37.4	U	10.1	37.4	370	ug/Kg
120-12-7	Anthracene	37.4	U	7.6	37.4	370	ug/Kg
206-44-0	Fluoranthene	37.4	U	7.5	37.4	370	ug/Kg
129-00-0	Pyrene	37.4	U	9	37.4	370	ug/Kg
56-55-3	Benzo(a)anthracene	37.4	U	17.9	37.4	370	ug/Kg
218-01-9	Chrysene	37.4	U	17	37.4	370	ug/Kg
205-99-2	Benzo(b)fluoranthene	37.4	U	12.2	37.4	370	ug/Kg
207-08-9	Benzo(k)fluoranthene	37.4	U	17.6	37.4	370	ug/Kg
50-32-8	Benzo(a)pyrene	37.4	U	8.1	37.4	370	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	37.4	U	12.5	37.4	370	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	37.4	U	10.8	37.4	370	ug/Kg
191-24-2	Benzo(g,h,i)perylene	37.4	U	15.2	37.4	370	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	89.1		31 - 132		89%	SPK: 100
321-60-8	2-Fluorobiphenyl	95.2		39 - 123		95%	SPK: 100
1718-51-0	Terphenyl-d14	85.7		37 - 115		86%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	116743	7.47				
1146-65-2	Naphthalene-d8	467680	9.5				
15067-26-2	Acenaphthene-d10	198870	12.33				
1517-22-2	Phenanthrene-d10	332234	14.74				
1719-03-5	Chrysene-d12	250501	18.46				
1520-96-3	Perylene-d12	191255	20.15				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-04	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	11
Sample Wt/Vol:	30.02 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087579.D	1	05/27/16 08:56	05/31/16 07:54	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-11.5-12	SDG No.:	H3323
Lab Sample ID:	H3323-05	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	5.9
Sample Wt/Vol:	5 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049773.D	1		05/27/16 15:46	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.53	U	0.53	0.53	5.3	ug/Kg
74-87-3	Chloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
75-01-4	Vinyl Chloride	0.53	U	0.53	0.53	5.3	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.3	ug/Kg
75-00-3	Chloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
75-69-4	Trichlorofluoromethane	0.53	U	0.53	0.53	5.3	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.53	U	0.53	0.53	5.3	ug/Kg
75-65-0	Tert butyl alcohol	26.6	U	7.9	26.6	26.6	ug/Kg
75-35-4	1,1-Dichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
67-64-1	Acetone	2.7	U	2.7	2.7	26.6	ug/Kg
75-15-0	Carbon Disulfide	0.53	U	0.53	0.53	5.3	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.53	U	0.53	0.53	5.3	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.3	ug/Kg
75-09-2	Methylene Chloride	4.4	J	0.53	0.53	5.3	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
75-34-3	1,1-Dichloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
110-82-7	Cyclohexane	0.53	U	0.53	0.53	5.3	ug/Kg
78-93-3	2-Butanone	8	U	3.3	8	26.6	ug/Kg
56-23-5	Carbon Tetrachloride	0.53	U	0.53	0.53	5.3	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
74-97-5	Bromochloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
67-66-3	Chloroform	0.53	U	0.53	0.53	5.3	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
108-87-2	Methylcyclohexane	0.53	U	0.53	0.53	5.3	ug/Kg
71-43-2	Benzene	0.53	U	0.4	0.53	5.3	ug/Kg
107-06-2	1,2-Dichloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
79-01-6	Trichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
78-87-5	1,2-Dichloropropane	0.53	U	0.28	0.53	5.3	ug/Kg
75-27-4	Bromodichloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.7	U	2.7	2.7	26.6	ug/Kg
108-88-3	Toluene	0.53	U	0.53	0.53	5.3	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.53	U	0.53	0.53	5.3	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-11.5-12	SDG No.:	H3323
Lab Sample ID:	H3323-05	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	5.9
Sample Wt/Vol:	5 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049773.D	1		05/27/16 15:46	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.53	U	0.53	0.53	5.3	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.96	1.1	5.3	ug/Kg
591-78-6	2-Hexanone	2.7	U	2.7	2.7	26.6	ug/Kg
124-48-1	Dibromochloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
106-93-4	1,2-Dibromoethane	0.53	U	0.53	0.53	5.3	ug/Kg
127-18-4	Tetrachloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
108-90-7	Chlorobenzene	0.53	U	0.53	0.53	5.3	ug/Kg
100-41-4	Ethyl Benzene	0.53	U	0.53	0.53	5.3	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.77	1.1	10.6	ug/Kg
95-47-6	o-Xylene	0.53	U	0.53	0.53	5.3	ug/Kg
100-42-5	Styrene	0.53	U	0.48	0.53	5.3	ug/Kg
75-25-2	Bromoform	1.6	U	0.79	1.6	5.3	ug/Kg
98-82-8	Isopropylbenzene	0.53	U	0.51	0.53	5.3	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.53	U	0.49	0.53	5.3	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.53	U	0.39	0.53	5.3	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.53	U	0.44	0.53	5.3	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.53	U	0.53	0.53	5.3	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.3	U	0.92	5.3	5.3	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.53	U	0.53	0.53	5.3	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.53	1.1	5.3	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	43.2		56 - 120		86%	SPK: 50
1868-53-7	Dibromofluoromethane	45		57 - 135		90%	SPK: 50
2037-26-5	Toluene-d8	41.5		67 - 123		83%	SPK: 50
460-00-4	4-Bromofluorobenzene	46.5		33 - 141		93%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	474687	6.34				
540-36-3	1,4-Difluorobenzene	734895	7.46				
3114-55-4	Chlorobenzene-d5	778898	11.59				
3855-82-1	1,4-Dichlorobenzene-d4	401506	13.93				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-11.5-12	SDG No.:	H3323
Lab Sample ID:	H3323-05	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	5.9
Sample Wt/Vol:	5 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049773.D	1		05/27/16 15:46	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-06	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	7.2 Decanted:
Sample Wt/Vol:	30.02 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016600.D	1	05/27/16 08:00	05/27/16 22:49	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	5420		897	900	1800	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	13.4		37 - 130		67%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-06	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	7.2 Decanted:
Sample Wt/Vol:	5.03 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006755.D	1	05/31/16 20:35	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	24	U	13	24	48	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	17.4		50 - 150		87%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements
J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 12:30
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-06	Matrix:	SOIL
		% Solid:	92.8

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Paint Filter	1.08	U	1	1.08	1.08	1.08	ml/100gm		05/27/16 10:15	9095A

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time
J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-06	Matrix:	SOIL
Analytical Method:	SW8082A	% Moisture:	7.2 Decanted:
Sample Wt/Vol:	30.07 Units: g	Final Vol:	10000 uL
Soil Aliquot Vol:	uL	Test:	PCB
Extraction Type:		Injection Volume :	
GPC Factor :	1.0 PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008717.D	1	05/27/16 09:10	05/31/16 23:03	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.6	U	3.6	3.6	18.3	ug/kg
11104-28-2	Aroclor-1221	3.6	U	3.6	3.6	18.3	ug/kg
11141-16-5	Aroclor-1232	3.6	U	3.6	3.6	18.3	ug/kg
53469-21-9	Aroclor-1242	3.6	U	3.6	3.6	18.3	ug/kg
12672-29-6	Aroclor-1248	3.6	U	3.6	3.6	18.3	ug/kg
11097-69-1	Aroclor-1254	3.6	U	1.6	3.6	18.3	ug/kg
37324-23-5	Aroclor-1262	3.6	U	3.6	3.6	18.3	ug/kg
11100-14-4	Aroclor-1268	3.6	U	3.6	3.6	18.3	ug/kg
11096-82-5	Aroclor-1260	3.6	U	3.6	3.6	18.3	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	16.3		10 - 166		81%	SPK: 20
2051-24-3	Decachlorobiphenyl	17.4		60 - 125		87%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-06	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	7.2
Sample Wt/Vol:	30.07 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087608.D	1	05/27/16 08:56	06/01/16 06:36	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	35.8	U	12.4	35.8	350	ug/Kg
208-96-8	Acenaphthylene	35.8	U	9	35.8	350	ug/Kg
83-32-9	Acenaphthene	35.8	U	10.1	35.8	350	ug/Kg
86-73-7	Fluorene	35.8	U	13.5	35.8	350	ug/Kg
85-01-8	Phenanthrene	380		9.7	35.8	350	ug/Kg
120-12-7	Anthracene	110	J	7.3	35.8	350	ug/Kg
206-44-0	Fluoranthene	670		7.2	35.8	350	ug/Kg
129-00-0	Pyrene	550		8.6	35.8	350	ug/Kg
56-55-3	Benzo(a)anthracene	350		17.1	35.8	350	ug/Kg
218-01-9	Chrysene	330	J	16.2	35.8	350	ug/Kg
205-99-2	Benzo(b)fluoranthene	370		11.7	35.8	350	ug/Kg
207-08-9	Benzo(k)fluoranthene	200	J	16.9	35.8	350	ug/Kg
50-32-8	Benzo(a)pyrene	330	J	7.7	35.8	350	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	170	J	11.9	35.8	350	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	35.8	U	10.3	35.8	350	ug/Kg
191-24-2	Benzo(g,h,i)perylene	180	J	14.5	35.8	350	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	69.8		31 - 132		70%	SPK: 100
321-60-8	2-Fluorobiphenyl	71.1		39 - 123		71%	SPK: 100
1718-51-0	Terphenyl-d14	56		37 - 115		56%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	135651	7.44				
1146-65-2	Naphthalene-d8	509528	9.47				
15067-26-2	Acenaphthene-d10	212962	12.3				
1517-22-2	Phenanthrene-d10	327429	14.71				
1719-03-5	Chrysene-d12	273511	18.42				
1520-96-3	Perylene-d12	235801	20.1				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-06	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	7.2
Sample Wt/Vol:	30.07 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087608.D	1	05/27/16 08:56	06/01/16 06:36	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-17.5-18	SDG No.:	H3323
Lab Sample ID:	H3323-07	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	4.8
Sample Wt/Vol:	4.99 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049774.D	1		05/27/16 16:14	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
75-71-8	Dichlorodifluoromethane	0.53	U	0.53	0.53	5.3	ug/Kg
74-87-3	Chloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
75-01-4	Vinyl Chloride	0.53	U	0.53	0.53	5.3	ug/Kg
74-83-9	Bromomethane	1.1	U	1.1	1.1	5.3	ug/Kg
75-00-3	Chloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
75-69-4	Trichlorofluoromethane	0.53	U	0.53	0.53	5.3	ug/Kg
76-13-1	1,1,2-Trichlorotrifluoroethane	0.53	U	0.53	0.53	5.3	ug/Kg
75-65-0	Tert butyl alcohol	26.3	U	7.8	26.3	26.3	ug/Kg
75-35-4	1,1-Dichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
67-64-1	Acetone	2.6	U	2.6	2.6	26.3	ug/Kg
75-15-0	Carbon Disulfide	0.53	U	0.53	0.53	5.3	ug/Kg
1634-04-4	Methyl tert-butyl Ether	0.53	U	0.53	0.53	5.3	ug/Kg
79-20-9	Methyl Acetate	1.1	U	1.1	1.1	5.3	ug/Kg
75-09-2	Methylene Chloride	4.7	J	0.53	0.53	5.3	ug/Kg
156-60-5	trans-1,2-Dichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
75-34-3	1,1-Dichloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
110-82-7	Cyclohexane	0.53	U	0.53	0.53	5.3	ug/Kg
78-93-3	2-Butanone	7.9	U	3.3	7.9	26.3	ug/Kg
56-23-5	Carbon Tetrachloride	0.53	U	0.53	0.53	5.3	ug/Kg
156-59-2	cis-1,2-Dichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
74-97-5	Bromochloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
67-66-3	Chloroform	0.53	U	0.53	0.53	5.3	ug/Kg
71-55-6	1,1,1-Trichloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
108-87-2	Methylcyclohexane	0.53	U	0.53	0.53	5.3	ug/Kg
71-43-2	Benzene	0.53	U	0.4	0.53	5.3	ug/Kg
107-06-2	1,2-Dichloroethane	0.53	U	0.53	0.53	5.3	ug/Kg
79-01-6	Trichloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
78-87-5	1,2-Dichloropropane	0.53	U	0.27	0.53	5.3	ug/Kg
75-27-4	Bromodichloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
108-10-1	4-Methyl-2-Pentanone	2.6	U	2.6	2.6	26.3	ug/Kg
108-88-3	Toluene	0.53	U	0.53	0.53	5.3	ug/Kg
10061-02-6	t-1,3-Dichloropropene	0.53	U	0.53	0.53	5.3	ug/Kg

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-17.5-18	SDG No.:	H3323
Lab Sample ID:	H3323-07	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	4.8
Sample Wt/Vol:	4.99 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049774.D	1		05/27/16 16:14	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
10061-01-5	cis-1,3-Dichloropropene	0.53	U	0.53	0.53	5.3	ug/Kg
79-00-5	1,1,2-Trichloroethane	1.1	U	0.95	1.1	5.3	ug/Kg
591-78-6	2-Hexanone	2.6	U	2.6	2.6	26.3	ug/Kg
124-48-1	Dibromochloromethane	0.53	U	0.53	0.53	5.3	ug/Kg
106-93-4	1,2-Dibromoethane	0.53	U	0.53	0.53	5.3	ug/Kg
127-18-4	Tetrachloroethene	0.53	U	0.53	0.53	5.3	ug/Kg
108-90-7	Chlorobenzene	0.53	U	0.53	0.53	5.3	ug/Kg
100-41-4	Ethyl Benzene	0.53	U	0.53	0.53	5.3	ug/Kg
179601-23-1	m/p-Xylenes	1.1	U	0.76	1.1	10.5	ug/Kg
95-47-6	o-Xylene	0.53	U	0.53	0.53	5.3	ug/Kg
100-42-5	Styrene	0.53	U	0.47	0.53	5.3	ug/Kg
75-25-2	Bromoform	1.6	U	0.78	1.6	5.3	ug/Kg
98-82-8	Isopropylbenzene	0.53	U	0.51	0.53	5.3	ug/Kg
79-34-5	1,1,2,2-Tetrachloroethane	0.53	U	0.48	0.53	5.3	ug/Kg
541-73-1	1,3-Dichlorobenzene	0.53	U	0.39	0.53	5.3	ug/Kg
106-46-7	1,4-Dichlorobenzene	0.53	U	0.43	0.53	5.3	ug/Kg
95-50-1	1,2-Dichlorobenzene	0.53	U	0.53	0.53	5.3	ug/Kg
96-12-8	1,2-Dibromo-3-Chloropropane	5.3	U	0.92	5.3	5.3	ug/Kg
120-82-1	1,2,4-Trichlorobenzene	0.53	U	0.53	0.53	5.3	ug/Kg
87-61-6	1,2,3-Trichlorobenzene	1.1	U	0.53	1.1	5.3	ug/Kg
SURROGATES							
17060-07-0	1,2-Dichloroethane-d4	52.1		56 - 120		104%	SPK: 50
1868-53-7	Dibromofluoromethane	52.2		57 - 135		104%	SPK: 50
2037-26-5	Toluene-d8	50.2		67 - 123		100%	SPK: 50
460-00-4	4-Bromofluorobenzene	57.1		33 - 141		114%	SPK: 50
INTERNAL STANDARDS							
363-72-4	Pentafluorobenzene	428304	6.33				
540-36-3	1,4-Difluorobenzene	652041	7.45				
3114-55-4	Chlorobenzene-d5	704579	11.6				
3855-82-1	1,4-Dichlorobenzene-d4	370974	13.94				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-17.5-18	SDG No.:	H3323
Lab Sample ID:	H3323-07	Matrix:	SOIL
Analytical Method:	SW8260	% Moisture:	4.8
Sample Wt/Vol:	4.99 Units: g	Final Vol:	5000 uL
Soil Aliquot Vol:	uL	Test:	VOCMS Group1
GC Column:	RTX-VMS ID : 0.18	Level :	LOW

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
VD049774.D	1		05/27/16 16:14	VD052716

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-08	Matrix:	SOIL
Analytical Method:	8015B DRO	% Moisture:	7 Decanted:
Sample Wt/Vol:	30.05 Units: g	Final Vol:	1 mL
Soil Aliquot Vol:	uL	Test:	Diesel Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
FE016601.D	1	05/27/16 08:00	05/27/16 23:23	PB90968

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
DRO	DRO	1540	J	895	895	1790	ug/kg
SURROGATES							
16416-32-3	Tetracosane-d50	11.5		37 - 130		57%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-08	Matrix:	SOIL
Analytical Method:	8015B GRO	% Moisture:	7 Decanted:
Sample Wt/Vol:	5.03 Units: g	Final Vol:	5 mL
Soil Aliquot Vol:	uL	Test:	Gasoline Range Organics
Extraction Type:		Injection Volume :	
GPC Factor :	PH :		

File ID/Qc Batch:	Dilution:	Date Analyzed	Prep Batch ID
FB006756.D	1	05/31/16 21:08	FB053116

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
GRO	GRO	24	U	13	24	48	ug/kg
SURROGATES							
98-08-8	Alpha,Alpha,Alpha-Trifluoroto	17.3		50 - 150		86%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 13:55
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-08	Matrix:	SOIL
		% Solid:	93

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Paint Filter	1.08	U	1	1.08	1.08	1.08	ml/100gm		05/27/16 10:15	9095A

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.		Date Collected:	05/26/16	
Project:	OEGS Rush		Date Received:	05/26/16	
Client Sample ID:	SB-05-COMP		SDG No.:	H3323	
Lab Sample ID:	H3323-08		Matrix:	SOIL	
Analytical Method:	SW8082A		% Moisture:	7	Decanted:
Sample Wt/Vol:	30.14	Units: g	Final Vol:	10000	uL
Soil Aliquot Vol:		uL	Test:	PCB	
Extraction Type:			Injection Volume :		
GPC Factor :	1.0	PH :			

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
PQ008718.D	1	05/27/16 09:10	05/31/16 23:18	PB90899

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
12674-11-2	Aroclor-1016	3.6	U	3.6	3.6	18.2	ug/kg
11104-28-2	Aroclor-1221	3.6	U	3.6	3.6	18.2	ug/kg
11141-16-5	Aroclor-1232	3.6	U	3.6	3.6	18.2	ug/kg
53469-21-9	Aroclor-1242	3.6	U	3.6	3.6	18.2	ug/kg
12672-29-6	Aroclor-1248	3.6	U	3.6	3.6	18.2	ug/kg
11097-69-1	Aroclor-1254	3.6	U	1.6	3.6	18.2	ug/kg
37324-23-5	Aroclor-1262	3.6	U	3.6	3.6	18.2	ug/kg
11100-14-4	Aroclor-1268	3.6	U	3.6	3.6	18.2	ug/kg
11096-82-5	Aroclor-1260	3.6	U	3.6	3.6	18.2	ug/kg
SURROGATES							
877-09-8	Tetrachloro-m-xylene	15.2		10 - 166		76%	SPK: 20
2051-24-3	Decachlorobiphenyl	15.8		60 - 125		79%	SPK: 20

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
P = Indicates >25% difference for detected concentrations between the two GC columns
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements
J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
S = Indicates estimated value where valid five-point calibration was not performed prior to analyte detection in sample.
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-08	Matrix:	SOIL
Analytical Method:	SW8270	% Moisture:	7
Sample Wt/Vol:	30.1 Units: g	Final Vol:	1000 uL
Soil Aliquot Vol:	uL	Test:	SVOC-PAH
Extraction Type :	Decanted : N	Level :	LOW
Injection Volume :	GPC Factor : 1.0	GPC Cleanup :	N PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087581.D	1	05/27/16 08:56	05/31/16 09:02	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units(Dry Weight)
TARGETS							
91-20-3	Naphthalene	35.7	U	12.3	35.7	350	ug/Kg
208-96-8	Acenaphthylene	35.7	U	9	35.7	350	ug/Kg
83-32-9	Acenaphthene	35.7	U	10.1	35.7	350	ug/Kg
86-73-7	Fluorene	35.7	U	13.5	35.7	350	ug/Kg
85-01-8	Phenanthrene	35.7	U	9.6	35.7	350	ug/Kg
120-12-7	Anthracene	35.7	U	7.3	35.7	350	ug/Kg
206-44-0	Fluoranthene	35.7	U	7.2	35.7	350	ug/Kg
129-00-0	Pyrene	35.7	U	8.6	35.7	350	ug/Kg
56-55-3	Benzo(a)anthracene	35.7	U	17	35.7	350	ug/Kg
218-01-9	Chrysene	35.7	U	16.2	35.7	350	ug/Kg
205-99-2	Benzo(b)fluoranthene	35.7	U	11.7	35.7	350	ug/Kg
207-08-9	Benzo(k)fluoranthene	35.7	U	16.8	35.7	350	ug/Kg
50-32-8	Benzo(a)pyrene	35.7	U	7.7	35.7	350	ug/Kg
193-39-5	Indeno(1,2,3-cd)pyrene	35.7	U	11.9	35.7	350	ug/Kg
53-70-3	Dibenzo(a,h)anthracene	35.7	U	10.3	35.7	350	ug/Kg
191-24-2	Benzo(g,h,i)perylene	35.7	U	14.5	35.7	350	ug/Kg
SURROGATES							
4165-60-0	Nitrobenzene-d5	74.1		31 - 132		74%	SPK: 100
321-60-8	2-Fluorobiphenyl	79.2		39 - 123		79%	SPK: 100
1718-51-0	Terphenyl-d14	67.7		37 - 115		68%	SPK: 100
INTERNAL STANDARDS							
3855-82-1	1,4-Dichlorobenzene-d4	125238	7.47				
1146-65-2	Naphthalene-d8	482784	9.5				
15067-26-2	Acenaphthene-d10	202258	12.33				
1517-22-2	Phenanthrene-d10	340943	14.73				
1719-03-5	Chrysene-d12	261661	18.46				
1520-96-3	Perylene-d12	194338	20.14				

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.			Date Collected:	05/26/16
Project:	OEGS Rush			Date Received:	05/26/16
Client Sample ID:	SB-05-COMP			SDG No.:	H3323
Lab Sample ID:	H3323-08			Matrix:	SOIL
Analytical Method:	SW8270			% Moisture:	7
Sample Wt/Vol:	30.1	Units:	g	Final Vol:	1000 uL
Soil Aliquot Vol:			uL	Test:	SVOC-PAH
Extraction Type :			Decanted : N	Level :	LOW
Injection Volume :			GPC Factor : 1.0	GPC Cleanup : N	PH :

File ID/Qc Batch:	Dilution:	Prep Date	Date Analyzed	Prep Batch ID
BF087581.D	1	05/27/16 08:56	05/31/16 09:02	PB90965

CAS Number	Parameter	Conc.	Qualifier	MDL	LOD	LOQ / CRQL	Units

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
E = Value Exceeds Calibration Range
Q = indicates LCS control criteria did not meet requirements
M = MS/MSD acceptance criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
N = Presumptive Evidence of a Compound
* = Values outside of QC limits
D = Dilution
() = Laboratory InHouse Limit

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 11:40
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-09	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	9.21		1	0	0	0	pH		05/27/16 09:35	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:45	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-02-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-09	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010
7440-39-3	Barium	752		1	40	125	500	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010
7440-47-3	Chromium	12.5	U	1	11	12.5	50	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/31/16 11:15	06/01/16 10:55	SW7470A
7782-49-2	Selenium	62.9	J	1	48	50.0	100	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/31/16 11:30	05/31/16 14:32	SW6010

Color Before:	Colorless	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 12:00
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-10	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	6.72		1	0	0	0	pH		05/27/16 09:37	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:45	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-03-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-10	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010
7440-39-3	Barium	563		1	40	125	500	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010
7440-47-3	Chromium	12.5	U	1	11	12.5	50	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/31/16 11:15	06/01/16 11:08	SW7470A
7782-49-2	Selenium	54.2	J	1	48	50.0	100	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/31/16 11:30	05/31/16 15:05	SW6010

Color Before:	Colorless	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 12:30
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-11	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	9.89		1	0	0	0	pH		05/27/16 09:38	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:53	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-04-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-11	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010
7440-39-3	Barium	772		1	40	125	500	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010
7440-47-3	Chromium	13.6	J	1	11	12.5	50	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/31/16 11:15	06/01/16 11:10	SW7470A
7782-49-2	Selenium	76.1	J	1	48	50.0	100	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/31/16 11:30	05/31/16 15:37	SW6010

Color Before:	Colorless	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16 13:55
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-12	Matrix:	SOIL
		% Solid:	100

Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
Corrosivity	7.76		1	0	0	0	pH		05/27/16 09:39	9045C
Ignitability	NO		1	0	0	0	o C		05/27/16 09:30	1030
Reactive Cyanide	0.05	U	1	0.05	0.05	0.05	mg/Kg	05/27/16 09:19	05/27/16 15:53	9012B
Reactive Sulfide	10	U	1	10	10	10	mg/Kg	05/27/16 09:19	05/27/16 11:45	9034

Comments:

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements
H = Sample Analysis Out Of Hold Time

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

CHEMTECH 284 Sheffield Street, Mountainside, NJ 07092 Phone: 908 789 8900 Fax: 908 789 8922

Report of Analysis

Client:	LiRo Engineers, Inc.	Date Collected:	05/26/16
Project:	OEGS Rush	Date Received:	05/26/16
Client Sample ID:	SB-05-COMP	SDG No.:	H3323
Lab Sample ID:	H3323-12	Matrix:	TCLP
Level (low/med):	low	% Solid:	0

Cas	Parameter	Conc.	Qua.	DF	MDL	LOD	LOQ / CRQL	Units	Prep Date	Date Ana.	Ana Met.
7440-38-2	Arsenic	25	U	1	25	25.0	100	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010
7440-39-3	Barium	827		1	40	125	500	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010
7440-43-9	Cadmium	7.5	U	1	5	7.5	30	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010
7440-47-3	Chromium	12.5	U	1	11	12.5	50	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010
7439-92-1	Lead	15	U	1	15	15.0	60	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010
7439-97-6	Mercury	1	U	1	1	1.0	2	ug/L	05/31/16 11:15	06/01/16 11:12	SW7470A
7782-49-2	Selenium	50	U	1	48	50.0	100	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010
7440-22-4	Silver	12.5	U	1	12.5	12.5	50	ug/L	05/31/16 11:30	05/31/16 15:41	SW6010

Color Before:	Colorless	Clarity Before:		Texture:	Clear
Color After:	Colorless	Clarity After:		Artifacts:	Clear
Comments:	TCLP METALS				

U = Not Detected
LOQ = Limit of Quantitation
MDL = Method Detection Limit
LOD = Limit of Detection
D = Dilution
Q = indicates LCS control criteria did not meet requirements

J = Estimated Value
B = Analyte Found in Associated Method Blank
* = indicates the duplicate analysis is not within control limits.
E = Indicates the reported value is estimated because of the presence of interference.
OR = Over Range
N =Spiked sample recovery not within control limits

Attachment B

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT

GROUNDWATER:				CAS.	SAMPLER	TUBE
DATE	TIME	LEVEL	TYPE	TYPE		
				DIA.		
				WT.		
				FALL		

BORING NO:	SB-01
SHEET:	1 Of 7
JOB NO.:	15-008-0265
LOCATION:	NW section of facility
GROUND ELEVATION:	
DATE STARTED:	May 25, 2016
DATE FINISHED:	May 25, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	Eva Jakubowska
REVIEWED BY:	

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Brown	Very Dense	0.0 - 6.0': Fine Sand with trace silt and gravel as well as boulders from blasted rock.	FILL	Hand Cleared to 6 ftbg 0.0 ppm Moist
6								Ended boring at 6 ftbg as planned.		
10										
15										
20										
25										
30										
35										

Comments: Grab sample collected @ 5.5 - 6.0 ftbg for VOCs. Composite sample collected from 0.0 - 6.0 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-01

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT

BORING NO:	SB-02
SHEET:	2 Of 7
JOB NO.:	15-008-0265
LOCATION:	SW section of facility
GROUND ELEVATION:	
DATE STARTED:	May 25, 2016
DATE FINISHED:	May 27, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	E. Jakubowska/M. Donovan
REVIEWED BY:	

GROUNDWATER:

DATE	TIME	LEVEL	TYPE

	CAS.	SAMPLER	TUBE
TYPE			
DIA.			
WT.			
FALL			

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Brown	Very Dense	0.0 - 6.0': Fine Sand and gravel with boulders from blasted rock. Entire bottom of boring is a solid layer.	FILL	Hand Cleared to 5 ftbg 0.0 ppm Moist
6					95%	Brown	Very Dense	6.0 - 9.0': Silt to fine Sand with gravel and a 1.5" asphalt layer at 7.5 ftbg.		0.0 ppm Moist
10								Ended boring at 9 ftbg due to refusal.		
15										
20										
25										
30										
35										

Comments: Grab sample collected @ 8.5 - 9.0 ftbg for VOCs. Composite sample collected from 0.0 - 9.0 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-02

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT

BORING NO:	SB-03
SHEET:	3 Of 7
JOB NO.:	15-008-0265
LOCATION:	South section of facility
GROUND ELEVATION:	
DATE STARTED:	May 27, 2016
DATE FINISHED:	May 27, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	E. Jakubowska/M. Donovan
REVIEWED BY:	

GROUNDWATER:

DATE	TIME	LEVEL	TYPE

	CAS.	SAMPLER	TUBE
TYPE			
DIA.			
WT.			
FALL			

DEPTH FEET	STRATA	SAMPLE "S" NO.	SAMPLE "N" NO.	BLOWS PER 6"	REC% RQD%	COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Brown	Very Dense	0.0 - 6.0': Fine Sand with gravel from blasted rock.	FILL	Hand Cleared to 5 ftbg 0.0 ppm Moist
6					95%	Brown to Light Brown	Medium to Very Dense	6.0 - 10.0': Clay to fine Sand with gravel.		0.0 ppm Moist
10								Ended boring at 10 ftbg as planned.		
15										
20										
25										
30										
35										

Comments: Grab sample collected @ 9.5 - 10.0 ftbg for VOCs. Composite sample collected from 0.0 - 10.0 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-03

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT

BORING NO:	SB-04
SHEET:	4 Of 7
JOB NO.:	15-008-0265
LOCATION:	SW section of facility
GROUND ELEVATION:	
DATE STARTED:	May 25, 2016
DATE FINISHED:	May 27, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	E. Jakubowska/M. Donovan
REVIEWED BY:	

GROUNDWATER:				CAS.	SAMPLER	TUBE
DATE	TIME	LEVEL	TYPE	TYPE		
				DIA.		
				WT.		
				FALL		

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Brown	Very Dense	0.0 - 6.0': Fine Sand with gravel from blasted rock.	FILL	Hand Cleared to 5 ftbg 0.0 ppm Moist
6					100%	Brown	Dense	6.0 - 10.0': Medium Sand with gravel and some silt. 1.5" asphalt layer at 8.5 ftbg.		0.0 ppm Moist
10					665%	Brown	Dense	10.0 - 12.0': Silt to coarse Sand with gravel.		0.0 ppm Moist
								Ended boring at 12 ftbg due to refusal.		
15										
20										
25										
30										
35										

Comments: Grab sample collected @ 11.5 - 12.0 ftbg for VOCs. Composite sample collected from 0.0 - 12.0 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-04

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\From EJ-MD\Boring logs Croton Water Treatment Plant

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT
BORING NO:	SB-05
SHEET:	5 Of 7
JOB NO.:	15-008-0265
LOCATION:	SW section of facility
GROUND ELEVATION:	
DATE STARTED:	May 24, 2016
DATE FINISHED:	May 27, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	E. Jakubowska/M. Donovan
REVIEWED BY:	

GROUNDWATER:				CAS.	SAMPLER	TUBE
DATE	TIME	LEVEL	TYPE	TYPE		
				DIA.		
				WT.		
				FALL		

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Brown	Very Dense	0.0 - 6.0': Fine Sand with gravel from blasted rock.	FILL	Hand Cleared to 5 ftbg 0.0 ppm Moist
6					75%	Brown	Very Soft	6.0 - 10.0': Silt to Sand with gravel.		0.0 ppm Moist
10					100%	Brown	Medium	10.0 - 15.0': Silt to Sand with gravel.		0.0 ppm Moist
15					80%	Brown	Medium to Dense	15.0 - 18.0': Clay to Sand with gravel.		0.0 ppm Moist
20								Ended boring at 18 ftbg due to refusal.		
25										
30										
35										

Comments: Grab sample collected @ 17.5 - 18.0 ftbg for VOCs. Composite sample collected from 0.0 - 18.0 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-05

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\From EJ-MD\Boring logs Croton Water Treatment Plant

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT

BORING NO:	SB-06
SHEET:	6 Of 7
JOB NO.:	15-008-0265
LOCATION:	SW section of facility
GROUND ELEVATION:	
DATE STARTED:	May 24, 2016
DATE FINISHED:	May 24, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	Eva Jakubowska
REVIEWED BY:	

GROUNDWATER:				CAS.	SAMPLER	TUBE
DATE	TIME	LEVEL	TYPE	TYPE		
				DIA.		
				WT.		
				FALL		

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Dark Brown	Dense	0.0 - 1.0': Layer of asphalt. 1.0' - 2.5': Compacted fill material. 2.5 - 3.5': Fine Sand and blasted boulders.	FILL	Hand Cleared to 6 ftbg 0.0 ppm Moist
6								Ended boring at 3.5 ftbg due to refusal.		
10										
15										
20										
25										
30										
35										

Comments: Grab sample collected @ 3.0 - 3.5 ftbg for VOCs. Composite sample collected from 0.0 - 3.5 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-06

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\From EJ-MD\Boring logs Croton Water Treatment Plant

LiRo Engineers, Inc.

TEST BORING LOG

PROJECT:	NYC DDC OEGS - 11505 - Croton Water Treatment Plant
CLIENT:	NYCDDC - OEGS - HED - CLUB
BORING CONTRACTOR:	ADT

BORING NO:	SB-07
SHEET:	7 Of 7
JOB NO.:	15-008-0265
LOCATION:	SW section of facility
GROUND ELEVATION:	
DATE STARTED:	May 24, 2016
DATE FINISHED:	May 24, 2016
DRILLER:	Rob Jackson
GEOLOGIST:	Eva Jakubowska
REVIEWED BY:	

GROUNDWATER:

DATE	TIME	LEVEL	TYPE

	CAS.	SAMPLER	TUBE
TYPE			
DIA.			
WT.			
FALL			

DEPTH FEET	SAMPLE STRATA	"S" NO.	"N" NO.	BLOWS PER 6"	REC% RQD%	DESCRIPTION COLOR	CONSISTENCY HARDNESS	MATERIAL DESCRIPTION	USCS	REMARKS
1					NA	Dark Brown	Dense	0.0 - 1.5': Gravel. 1.5' - 3.5': Clay and fine Sand with gravel and blasted boulders.	FILL	Hand Cleared to 6 ftbg 0.0 ppm Moist
6								Ended boring at 3.5 ftbg due to refusal.		
10										
15										
20										
25										
30										
35										

Comments: Grab sample collected @ 3.0 - 3.5 ftbg for VOCs. Composite sample collected from 0.0 - 3.5 ftbg for remaining parameters. Soil was classified according to the Unified Soil Classification System (USCS).

PROJECT NO.: 15-008-0265
BORING NO.: SB-07

J:\15-008-0265 2015 DDC BEGS\Projects\Phase I - Phase II\11505 Croton Water Treatment Plant Ph II ESA\From EJ-MD\Boring logs Croton Water Treatment Plant

GEOTECHNICAL INTERPRETIVE REPORT
CROTON P4 HED-CLUB
New York, New York

October 2, 2017

Grimshaw
637 West 27th Street
New York, New York 10001

MRCE
built on firm foundations

Mueser Rutledge Consulting Engineers
225 West 34th Street
New York, New York 10122

MRCE

built on firm foundations

PARTNERS
Peter W. Deming
Roderic A. Ellman, Jr.
Francis J. Arland
David R. Good
Walter E. Kaeck

ASSOCIATE PARTNERS
Tony D. Canale
Jan Cermak
Sitotaw Y. Fantaye

SENIOR ASSOCIATES
Domenic D'Argenzio
Robert K. Radske
Ketan H. Trivedi
Hiren J. Shah
Alice Arana
Joel L. Volterra
Frederick C. Rhyner
Steven R. Lowe
Andrew R. Tognon
Gregg V. Piazza
James M. Tantalla
T. C. Michael Law

ASSOCIATES
Douglas W. Christie
Andrew Pontecorvo
Renzo D. Verastegui
Srinivas Yenamandra
Alex Krutovskiy
Farid Vastani
Jesse L. Richins
Jong W. Choi
Raj S. Chinthamani
Andrew R. Klaetsch
Peter L. Madarasz

TECHNICAL SPECIALISTS
David M. Cacoilo
Alfred H. Brand
James L. Kaufman
Hugh S. Lacy
Joel Moskowitz
George J. Tamaro
Elmer A. Richards

FINANCE DIRECTOR
Joseph N. Courtade

MARKETING DIRECTOR
Martha J. Huguet

October 2, 2017

Grimshaw
637 West 27th Street
New York, NY 10001

Attn: Mr. Eric Johnson

Re: Geotechnical Interpretive Report
Croton P4 HED-CLUB
Borough of the Bronx, New York
MRCE 13103

Dear Mr. Johnson:

In accordance with our agreement dated August 23, 2017, Mueser Rutledge Consulting Engineers (MRCE) has reviewed existing subsurface information for the proposed golf clubhouse next to the existing below-grade Croton Water Filtration Plant. This report summarizes our interpretations of subsurface conditions and provides foundation design and construction recommendations.

PROJECT DESCRIPTION

We understand that you are planning to build a one-story golf clubhouse next to the existing below-grade Croton Water Filtration Plant. The site is currently unoccupied and is bound by the MTA NYCT Woodlawn station to the east, and the Mosholu Golf Course above the water treatment facility to the west.

All recommendations are in accordance with the 1968 New York City Building Code latest edition as per project requirements. Elevations in this report are in feet and reference the North America Vertical Datum of 1988 (NAVD88).

EXHIBITS

The following exhibits are attached:

Exhibit	Description
Figure No. B-1	Boring Location Plan
Figure No. GS-1 & GS-2	Geologic Section
Appendix A	2017 Geotechnical Data Report
Appendix B	2000 Boring Logs in Project Vicinity

AVAILABLE INFORMATION

A subsurface investigation for the Croton Water Treatment Plant was performed in 2017 by CDM Smith, consisting of 18 geotechnical borings within the proposed footprint of the clubhouse structure and 2 groundwater observation wells.

A previous investigation was performed in 2000 by Hazen and Sawyer consisting of 51 test borings and 35 air-track probes. From this investigation, four borings are within the proposed footprint of the clubhouse structure.

SUBSURFACE CONDITIONS

The project is located in the Manhattan Prong of the New England Upland Physiographic Province and the bedrock is of the Fordham Gneiss Formation. Bedrock is relatively shallow in this area and is overlain by Upper Pleistocene deposits composed of outwash sand and gravel that has accumulated in depressions on the bedrock.

Our interpretation of the subsurface conditions encountered during the boring investigations by others is described below and shown graphically on Figure Nos. GS-1 and GS-2. The subsurface profile is summarized by strata in order of their general occurrence with depth, as follows:

Stratum F – Fill (NYCBC Class 11-65)
Stratum F is composed of brown fine to coarse sand, some to trace gravel, trace to some silt, cobbles, and boulders. The 2017 borings did not collect split spoon samples through this stratum in several borings. Where recorded, SPT N-values ranged from 7 blows per foot (bpf) to 61 bpf and have an average value equal to 28 bpf. Stratum F is between 5 feet and 10 feet thick across the site.

Stratum S – Sand (NYCBC Class 7-65 to 6-65)
Stratum S was encountered below the fill and is composed of brown fine to medium sand, some to trace silt, and trace gravel. Boulders and layers of gravel with some sand and silt were frequently encountered within this stratum. SPT N-values vary from 10 bpf to refusal and have an average value equal to 51 bpf. The bottom of Stratum S is approximately 12 feet to 45 feet below ground surface (Elev. +166 to +151).

Stratum WR – Weathered Rock (NYCBC Class 3-65 to 4-65)
Weathered rock was encountered above sound bedrock in seven of the 2017 borings and was generally classified as gray and dark gray soft to moderately hard moderately weathered to highly weathered gneiss. Top of weathered rock was encountered between Elev. +152 to +164. Percent recovery was between 22% and 77%, and Rock Quality Designation (RQD) ranged from 0% to 45%.

Stratum R – Bedrock (NYCBC Class 1-65 to 2-65)
Bedrock was classified as gray hard to moderately hard slightly weathered to moderately weathered gneiss with occasional seams of slightly weathered pegmatite. Top of sound bedrock was encountered between Elev. +151 to +168. Percent recovery was between 80% and 100% and the RQD was between 50% and 100%.

Groundwater
Groundwater observation wells were installed in two borings during the 2017 investigation, one in Boring B-1 (OW) at the north end of the site and one at B-13 (OW) at the south end of the site. Groundwater was reported at approximately Elev. +168 at both locations, just above the top of bedrock.

FOUNDATION RECOMMENDATIONS

Shallow Foundation Design

The proposed bottom of foundation elevations follow the general topography of the top of Stratum S on the east side of the building, and are dictated by the proposed basement elevations on the west side of the building. Assuming that all footings will bear on compacted natural granular material (Stratum S), we recommend an allowable bearing pressure equal to 4 tsf for the proposed footings. Design parameters for each subsurface strata are tabulated in Table 1. These values were calculated based on correlations with SPT N-Values and the available laboratory test data.

Table 1: Geotechnical Design Parameters

Stratum	φ' (deg)	γ (pcf)	γ' (pcf)	K_o	K_a
Fill (F)	30	120	57.6	0.50	0.33
Sand (S)	34	125	62.6	0.44	0.28
Select Common Fill	34	125	62.6	0.44	0.28

Lateral Pressure on Foundation Walls

Natural soils will be excavated for construction of the footings and foundation walls. We recommend using a compacted select common fill behind the finished foundation walls, consisting of granular fill with less than 15% fines. Lateral earth pressures on foundation walls should assume at-rest conditions. Lateral pressures on retaining walls should assume active conditions.

Hydrostatic Uplift Pressures

We recommend using a design groundwater table at Elev. +168. Based on the proposed designs, the groundwater table will be below the lowest foundation level.

Settlement

Due to the dense granular subsurface profile, short term and long term settlement across the site is expected to be minimal and uniform. We estimate total settlement to be on the order of 0.5-0.75 inches and will mostly occur during construction.

Seismic Design

The 1995 NYC Seismic Code was issues as a supplemental Reference Standard to the 1968 NYCBC and recommends a Seismic Zone Factor, Z, for buildings, structures, and portions thereof in New York City equal to 0.15, which represents the effective zero period acceleration for S_1 type rock. The soil profile type, S, for this site is S_1 based on the soil profile and SPT N-values, which corresponds to a Site Coefficient of 1.0 for foundations bearing on medium dense to very dense granular soils.

Liquefaction potential was evaluated based on SPT N-values with depth and compared to criteria presented in the Code. The groundwater table is approximately 20 feet below ground surface and due to the high N-values in Stratum S liquefaction is unlikely and does not need to be considered in design.

CONSTRUCTION CONSIDERATIONS

Excavations will be required to construct the building foundations. These temporary construction excavations should be sloped as necessary for safety and stability or supported by sheeting and bracing in accordance with OSHA regulations while protecting adjacent structures and pavements. Where space

permits, the excavations sides can be sloped no steeper than 1V:1.5H. If sloped excavation sides are not practical, temporary shoring is required,

The construction requires excavation through predominantly granular fill and natural overburden soils. Excavation of these materials using typical earthwork equipment is expected. The majority of the excavation for foundation construction is anticipated to be above the measured groundwater table. At the north end of the site where the groundwater table may be at or slightly below the proposed excavation, temporary dewatering may be required to lower the water table to at least 2 feet below the final footing subgrade.

We understand that the proposed construction includes well structures that may bear on or require shallow excavation of bedrock. An allowable bearing of 20 tsf can be used for any such structures bearing on bedrock. The rock excavation for well structures should be performed prior to excavation for shallow footing foundations. The rock excavation will need to be performed in a controlled manner possibly with perimeter line drilling to reduce the risk of over-breaks and reduce vibrations induced by the rock removal. Hydraulic hoe rams will likely be adequate for the removal. An adequately stiff excavation technique and support will be required where well excavation is within influence of adjacent building footings or other structures. Temporary construction dewatering will also be needed unless the excavation support also provides groundwater cutoff.

A precondition survey of the adjacent structures should be done prior to construction to verify available foundation information and document existing conditions. Following the precondition surveys, the effects of proposed excavation and foundation loads on the adjacent structures should be reviewed. Displacement and vibration monitoring of the structures should be performed during construction.

Care must be exercised to prevent disturbing or loosening of the soil in the sides and bottom of excavations. The proposed structure is founded on footings or slabs on grade and requires support on undisturbed subgrade. Construction documents should require the contractor to lower and control perched water levels in advance of excavation, along with excavation sequencing/sacrificial lifts to minimize soil disturbance due to exposure to water and to prevent freezing in cold weather. Final cut to subgrade should be made carefully using hand tools or an excavator fitted with a smooth edge bucket and working at least two feet above subgrade. Excavation subgrades should be protected from weather to prevent deterioration and graded to avoid ponding and accumulation of surface water, which can cause softening of exposed subgrades. In cold weather, measures should be taken to prevent freezing of foundation subgrades. Equipment should not run directly on the subgrade to avoid rutting or disturbance. If subgrade is loosened or disturbed during excavation, the disturbed soil must be over-excavated and replaced with concrete or compacted structural fill. Structural fill shall be used only if depth of disturbance is less than 2 feet.

For slab on grade and retaining wall construction, subgrade should be proof rolled with a heavy walk-behind static compactor to verify its integrity. Hard points, such as building remnants and boulders, should be removed a minimum of one foot below the subgrade. If soft, spongy, or otherwise unsatisfactory material is encountered, that material should be removed and replaced with compacted granular fill, crushed stone or flowable fill. If additional fill is needed it shall satisfy the gradation requirements for Controlled Fill in the 1968 Code (unless otherwise approved by the Engineer) and should be compacted to a minimum of 95% of Standard Proctor Density. The gradation and compaction means and methods shall be approved by the Engineer. Reuse of existing on-site soils as fill is possible in landscaped areas. If this material is to be used as backfill behind retaining walls or for supporting slab on grade, more detailed gradation testing and evaluations need to be performed to establish the material suitability. Screening of oversized particles from these materials will be required if to be used for any fill.

All subgrade soils supporting the shallow foundation elements must be inspected and approved by a qualified Special Inspector in accordance with the NYC Building Code prior to placing reinforcing steel or concrete.

Please don't hesitate to contact us with any questions.

Very truly yours,
MUESER RUTLEDGE CONSULTING ENGINEERS

Jan Cermak, P.E.

LL:JC:F:\131\13103\Report\MRCE Geotechnical Interpretive Report.docx

Exhibits

INE-GRAINED SOIL

ıe	Thread Dia.	Plasticity Index
	None	Zero
LT	1/4 inch thread	1 to 5
Y	1/8 inch thread	5 to 10
T	1/16 inch thread	10 to 20
'	1/32 inch thread	20 to 40
	1/64 inch thread	40 or more

TION SYSTEM

Typical Descriptions
organic silts and very fine sands, rock flour, silty clayey fine sands or clayey silts with slight plasticity
organic clays of low to medium plasticity, gravelly ays, sandy clays, silty clays, lean clays.
rganic silts and organic silty clays of low plasticity
organic silt, micaceous or diatomaceous fine ndy or silty soils, elastic silts.
organic clays of high plasticity. Fat clays.
rganic clays of medium to high plasticity, ganic silts.
eat and other highly organic soils.

ATION

ERING:

) - No visible sign of rock material ıg, perhaps slight discoloration on major uity surfaces

Discoloration indicates weathering of erial and discontinuity surfaces. All the erial may be discolored by weathering and omewhat weaker externally than in its ıdition

ly (Mod) - Less than half of the rock s decomposed and/or disintegrated to a h or discolored rock is present either as a ıs framework or as corestones

More than half of the rock material is sed and/or disintegrated to a soil. Fresh ored rock is present either as a uous framework or as corestones

ly (Comp) - All rock material is sed and/or disintegrated to soil. The ıass structure is still largely intact

e (Mod): 8 inches to 2 feet
to 6 feet
Wide: 6 to 20 feet

OH). Soil with less than 12 percent is classified as "trace classified as Peat (PT).
soil description by visual identification and field tests by the

extraction method to 6 feet below ground surface. Strata n visual observations and field judgement by the field inspector. ze is not included in the sample description. If any of the two han 10 percent, then report all sizes. anical breaks from drilling equipment are not accounted in the

ock, especially the planar structure that results from flattening of

ID

DETAILS

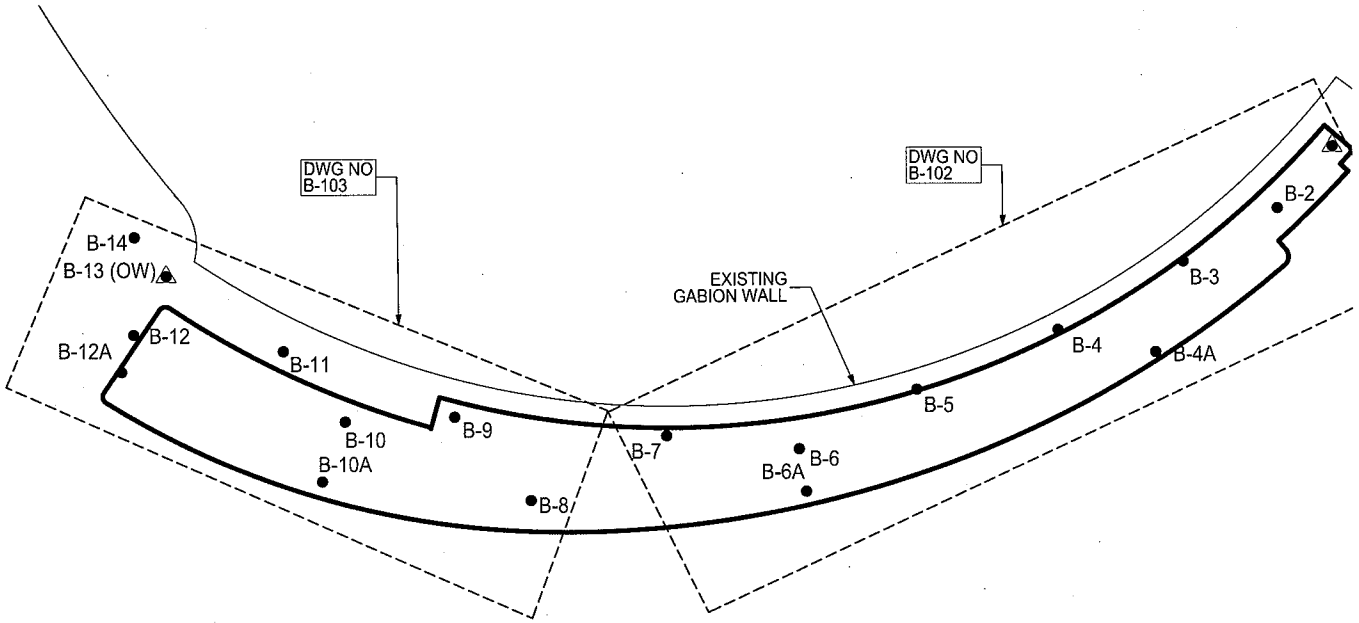
of sample
ttom of boring
ation and start date of the drilling
ata boundary and elevation
strata boundary and elevation
ng or drilling mud
Code Class of Materials
4)
ng was terminated
(EOB) depth

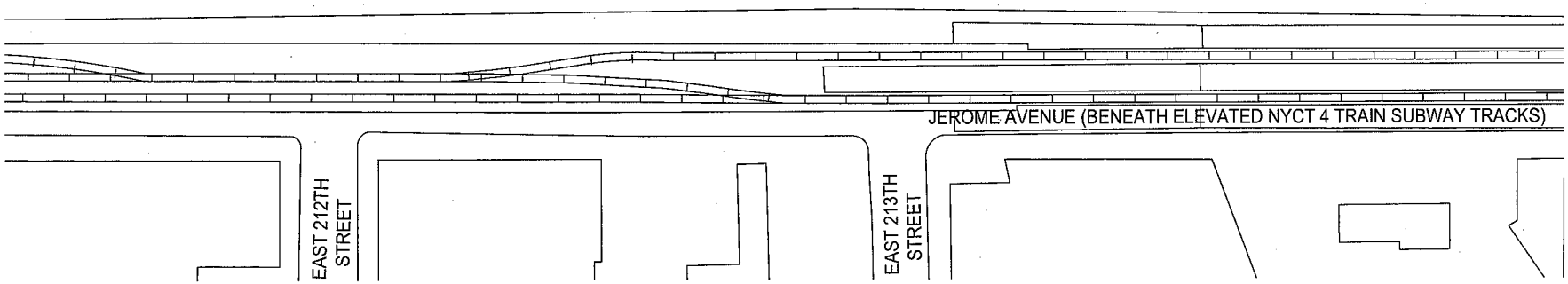
AMPLES

specified, sample spoon was driven 24 inches.
lows required to drive sample spoon for each 6-inch penetration in accordance with ASTM D-1586
f hammer
f rod
ber or :
ample
ed sample
ecovered in the split spoon (inches)

ILLING

start of core drilling
completion of Run
f rock core recovered
f Rock Quality Designation (RQD)
of Intact and Sound Rock ≥ 4") / (Core Run Length)
minutes/foot for
and boulder





GENERAL NOTE:
FOOTPRINT OF THE PROPOSED CLUBHOUSE WAS BASED IN SHEET # CROB_G_051, DATED 5/16/2016, PREPARED BY GRIMSHAW ARCHITECTURE.

DRAWING INDEX	
SHEET NO.	CONTENTS
B-101	LOCATION KEY PLAN
B-102	BORINGS B-1 TO B-7, B-4A & B-6A
B-103	BORINGS B-8 TO B-14, B-10A & B-12A

LOCATION KEY PLAN
SCALE: 1" = 40'
40 0 40

LEGEND
TEST BORING
TEST BORING WITH OBSERVATION WELL

IMPORTANT NOTES:

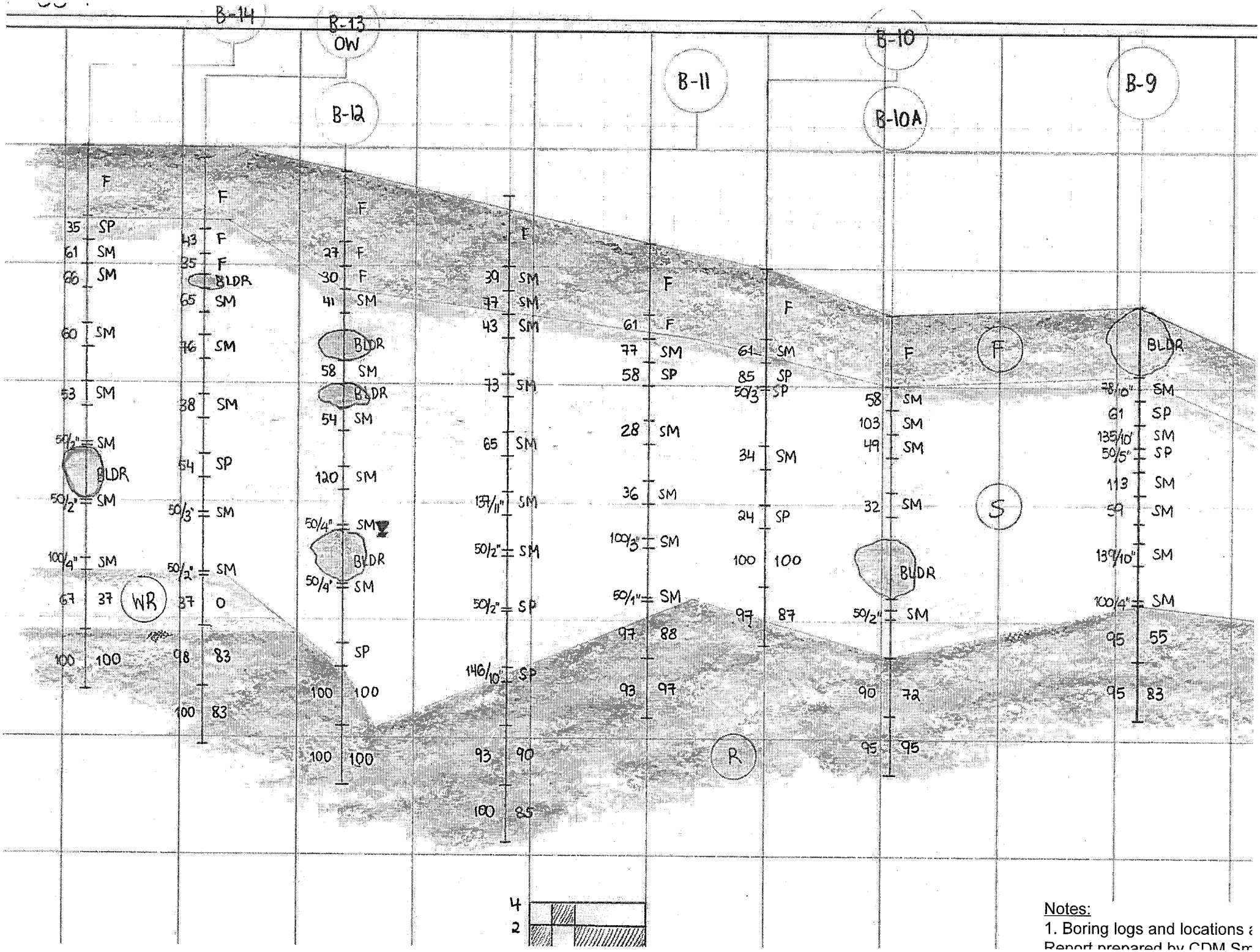
1. The Boring Logs shown on this sheet are the result of inferences drawn by the engineers or scientists during boring operations at the site, and from certain visual evidence such as: (a) samples of subsurface materials recovered during boring operations; (b) the logs kept by the drill operator and the inspector, which contain, among other things, expression of their opinions as to the nature of subsurface materials encountered during boring operations; and (c) other records concerning the site deemed pertinent by the engineers. The driller's log, the inspector's log, the samples and the records, together with the engineer's reports, are made available for inspection and study by the bidders so that they may draw their own inferences from all of the available evidence.

NYC DDC Department of Design and Construction

HED-CLUB
4069A

CONSULTANT NAME:
CDM SMITH
14 WALL STREET, SU
NEW YORK, NEW YOR

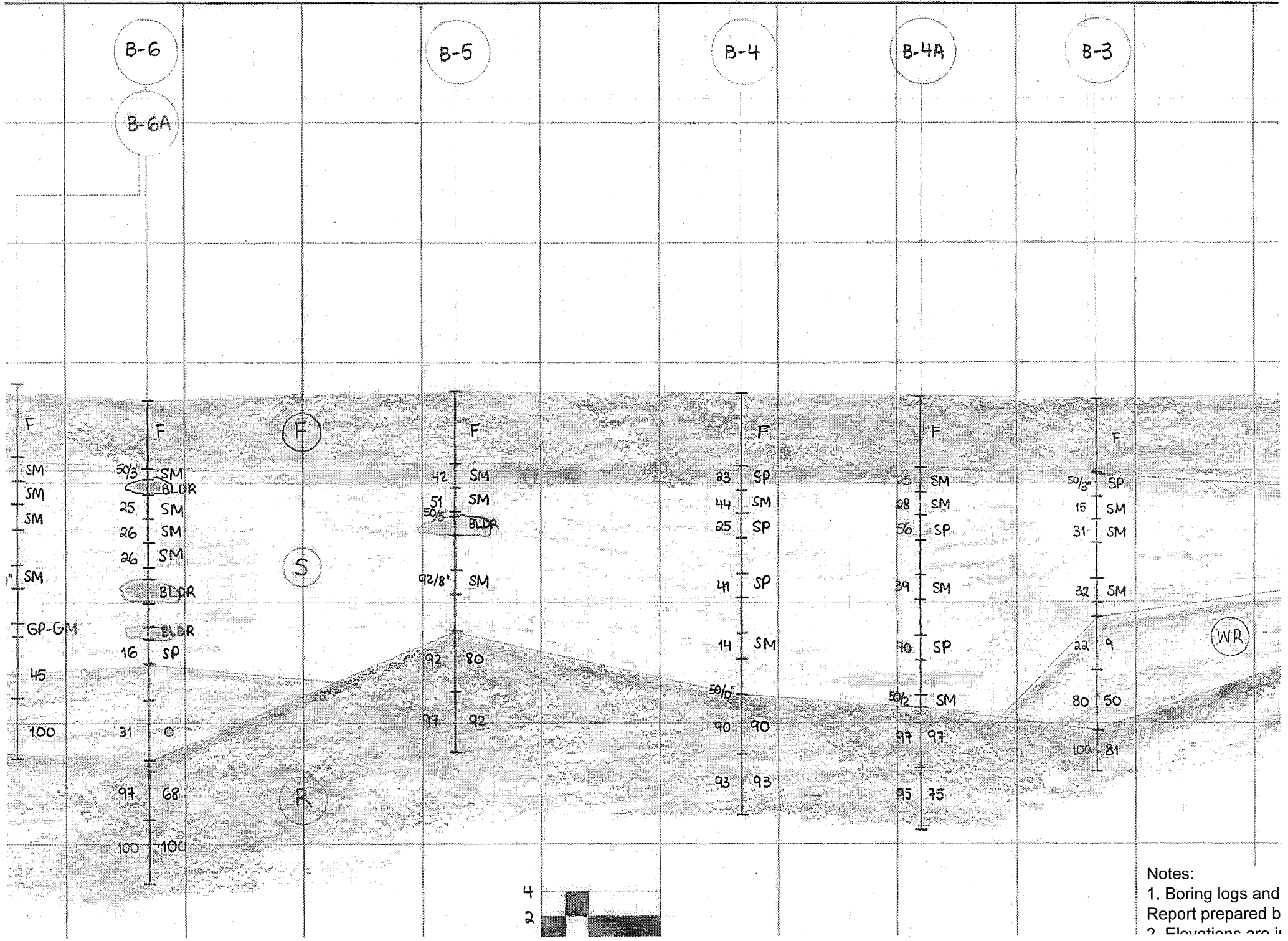
PROJECT NAME:
CROTON WA



Notes:

1. Boring logs and locations a

Report prepared by CDM Sm



Notes:
1. Boring logs and
Report prepared b
2. Elevations are i

Appendix A – 2007 Geotechnical Data Report

GEOTECHNICAL DATA REPORT

DDC PROJECT: Croton Water Treatment Plant
Van Cortlandt Park
Borough of The Bronx, New York

SES NO.: 4069A

CONTRACT REG NO.: 20151402686

WORK ORDER NO.: 12243-CDM-1-11099

Prepared for:

Department of Design and Construction

City of New York Department of Design and Construction
Bureau of Environmental and Geotechnical Services
30-30 Thomson Avenue, Fourth Floor
Long Island City, New York 11101

Prepared by:

CDM Smith
14 Wall Street, Suite 1702
New York, New York 10005

DDC Project No.: HED-CLUB
March 29, 2017

CDM Smith

To: *Jeffrey K. Au, P.E., Geotechnical Engineer, DDC BEGS*
Richard Meserole, Section Chief, DDC BEGS

From: *Robert Bunting, P.E.*

Date: *March 29, 2017*

RE: *GEOTECHNICAL DATA REPORT (PRELIMINARY)*
DDC Project #HED-CLUB
Croton Water Treatment Plant
Van Cortlandt Park
Borough of The Bronx, NY

Contract Code CDM and Registration Number:	20151402686
Task ID #:	12243 - Geotechnical II: Project Oversight
CDM Smith WOL #:	12243-CDM-1-11099
Location and Details:	3701 Jerome Avenue 14 borings @ 50'

This report was developed as the final deliverable for the subsurface investigation at the Croton Water Treatment Plant in The Bronx project performed from November 30, 2016 to February 28, 2017. This report contains the following data:

- Record of Borings for B-1 through B-14
- Rock Core Logs for B-1 through B-14
- Geotechnical Laboratory Test Results for samples collected at B-1 through B-14

RECORD OF BORINGS

Zone 3104	Geographic		NAD83		NAD27		BRONX	
BORING	Lat (N)	Lng(W)	N	E	N	E	E	S
B-1	40.886706	-73.8799218	262351.76	1017452.11	240909.27	2033203.01	5532.93	7601.90
B-2	40.886598	-73.8798688	262312.22	1017466.83	240869.73	2033217.72	5564.96	7574.44
B-3	40.886437	-73.8798692	262253.70	1017466.80	240811.22	2033217.69	5593.27	7523.23
B-4	40.886227	-73.8798604	262176.95	1017469.35	240734.47	2033220.24	5632.67	7457.31
B-4A	40.8864	-73.879737	262240.16	1017503.38	240797.67	2033254.27	5631.83	7529.10
B-5	40.886018	-73.8798944	262100.95	1017460.05	240658.46	2033210.95	5661.35	7386.31
B-6	40.88582	-73.8799078	262028.73	1017456.44	240586.25	2033207.33	5693.16	7321.38
B-6A	40.885782	-73.879723	262015.00	1017507.56	240572.52	2033258.45	5744.54	7334.13
B-7	40.88566	-73.8800528	261970.57	1017416.42	240528.09	2033167.31	5686.31	7251.11
B-8	40.885463	-73.8800441	261898.51	1017418.93	240456.03	2033169.82	5723.42	7189.28
B-9	40.885398	-73.8802771	261874.91	1017354.54	240432.43	2033105.43	5678.51	7137.44
B-10	40.885249	-73.8803711	261820.59	1017328.61	240378.11	2033079.50	5682.12	7077.36
B-10A	40.885202	-73.88031	261803.46	1017345.54	240360.98	2033096.42	5705.23	7070.58
B-11	40.88523	-73.8805412	261813.68	1017281.60	240371.20	2033032.48	5644.34	7048.55
B-12	40.885075	-73.8807565	261757.10	1017222.14	240314.62	2032973.02	5619.72	6970.24
B-12A	40.884992	-73.8807224	261726.80	1017231.61	240284.32	2032982.49	5642.68	6948.32
B-13	40.885126	-73.8807823	261775.45	1017214.97	240332.98	2032965.86	5604.56	6982.83
B-14	40.885127	-73.880925	261775.97	1017175.53	240333.49	2032926.42	5569.80	6964.18

INE-GRAINED SOIL

ıe	Thread Dia.	Plasticity Index
	None	Zero
LT	1/4 inch thread	1 to 5
Y	1/8 inch thread	5 to 10
T	1/16 inch thread	10 to 20
′	1/32 inch thread	20 to 40
	1/64 inch thread	40 or more

TION SYSTEM

Typical Descriptions
organic silts and very fine sands, rock flour, silty clayey fine sands or clayey silts with slight plasticity
organic clays of low to medium plasticity, gravelly ays, sandy clays, silty clays, lean clays.
rganic silts and organic silty clays of low plasticity
organic silt, micaceous or diatomaceous fine ndy or silty soils, elastic silts.
organic clays of high plasticity. Fat clays.
rganic clays of medium to high plasticity. ganic silts.
eat and other highly organic soils.

ATION

ERING:

) - No visible sign of rock material
ıg, perhaps slight discoloration on major uity surfaces

Discoloration indicates weathering of erial and discontinuity surfaces. All the erial may be discolored by weathering and omewhat weaker externally than in its dition

ly (Mod) - Less than half of the rock s decomposed and/or disintegrated to a h or discolored rock is present either as a ıs framework or as corestones

Aore than half of the rock material is sed and/or disintegrated to a soil. Fresh ıred rock is present either as a uous framework or as corestones

ly (Comp) - All rock material is sed and/or disintegrated to soil. The ıass structure is still largely intact

(Mod): 8 inches to 2 feet
to 6 feet
Wide: 6 to 20 feet

OH). Soil with less than 12 percent is classified as "trace lassified as Peat (PT).
soil description by visual identification and field tests by the

extraction method to 5 feet below ground surface. Strata n visual observations and field judgement by the field inspector. ze is not included in the sample description. If any of the two han 10 percent, then report all sizes.
anical breaks from drilling equipment are not accounted in the

ock, especially the planar structure that results from flattening of

ID

DETAILS

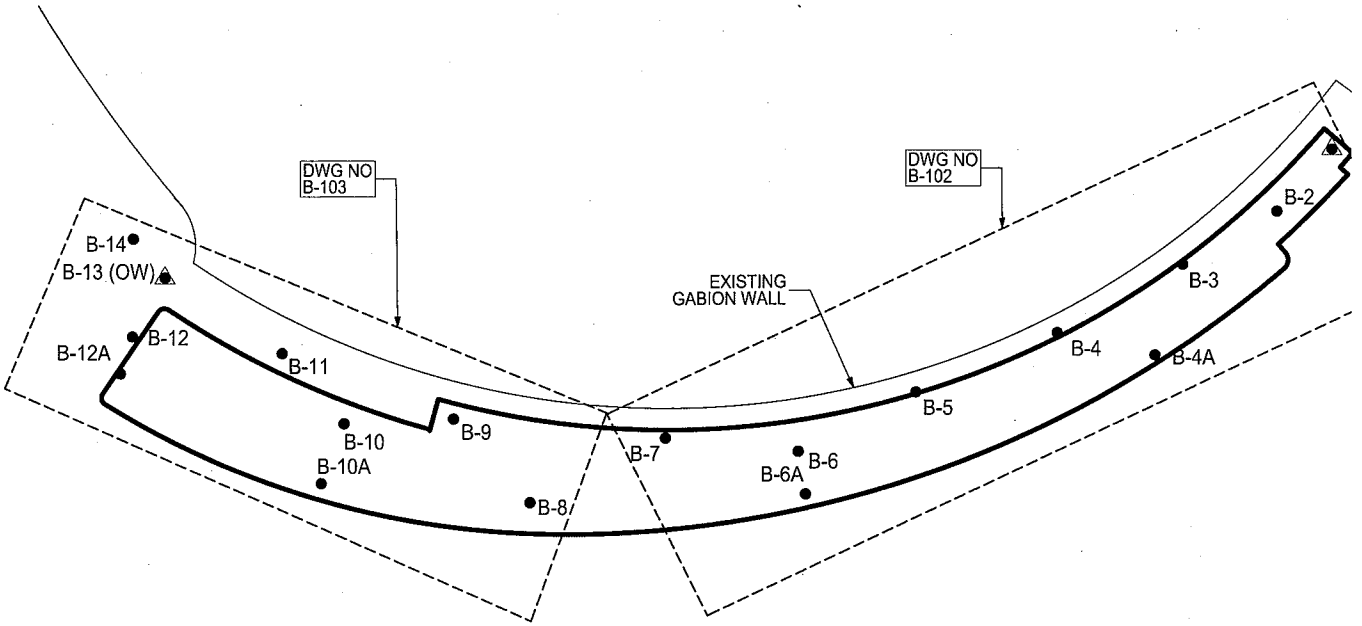
of sample
ttom of boring
ation and start date of the drilling
ata boundary and elevation
strata boundary and elevation
ng or drilling mud
Code Class of Materials
4)
ıg was terminated
(EOB) depth

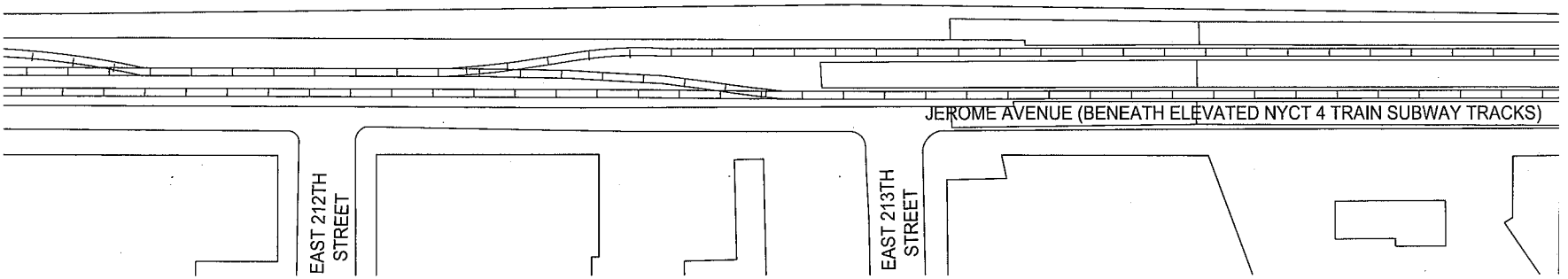
AMPLES

specified, sample spoon was driven 24 inches.
lows required to drive sample spoon for each 6-inch penetration in accordance with ASTM D-1586
f hammer
f rod
ber or :
ample
ed sample
ecovered in the split spoon (inches)

ILLING

start of core drilling
completion of Run
f rock core recovered
f Rock Quality Designation (RQD)
of Intact and Sound Rock ≥ 4") / (Core Run Length)
minutes/foot for
and boulder





GENERAL NOTE:
FOOTPRINT OF THE PROPOSED CLUBHOUSE WAS BASED IN SHEET # CROB_G_051, DATED 5/16/2016, PREPARED BY GRIMSHAW ARCHITECTURE.

DRAWING INDEX	
SHEET NO.	CONTENTS
B-101	LOCATION KEY PLAN
B-102	BORINGS B-1 TO B-7, B-4A & B-8A
B-103	BORINGS B-8 TO B-14, B-10A & B-12A

LOCATION KEY PLAN
SCALE: 1" = 40'
40 0 40

LEGEND
TEST BORING
TEST BORING WITH OBSERVATION WELL

IMPORTANT NOTES:

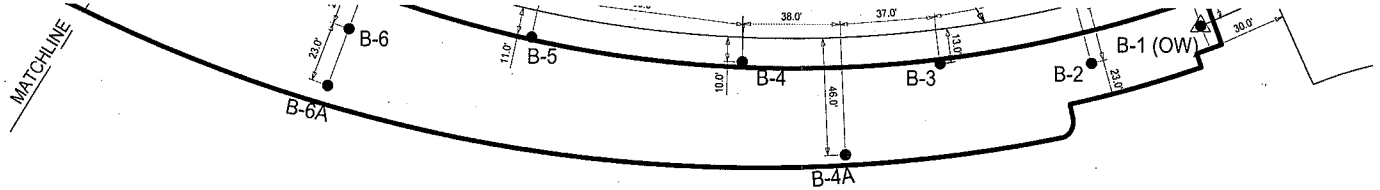
1. The Boring Logs shown on this sheet are the result of inferences drawn by the engineers or scientists during boring operations at the site, and from certain visual evidence such as: (a) samples of subsurface materials recovered during boring operations; (b) the logs kept by the drill operator and the inspector, which contain, among other things, expression of their opinions as to the nature of subsurface materials encountered during boring operations; and (c) other records concerning the site deemed pertinent by the engineers.The driller's log, the inspector's log, the samples and the records, together with the engineer's reports, are made available for inspection and study by the bidders so that they may draw their own inferences from all of the available evidence.

NYC DDC Department of Design and Construction

HED-CLUB
4069A

CONSULTANT NAME:
CDM SMITH
14 WALL STREET, SU
NEW YORK, NEW YOR

PROJECT NAME:
CROTON WA



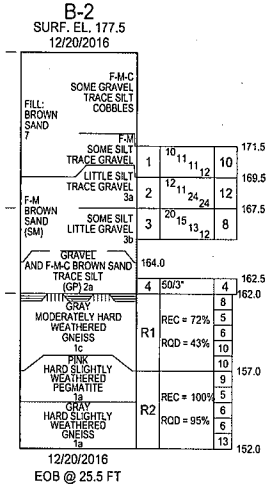
LOCATION PLAN

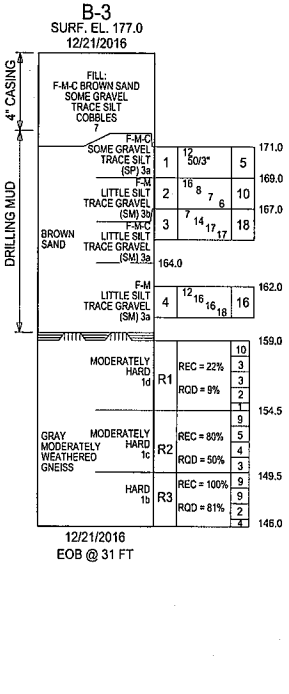
SCALE: 1" = 30'

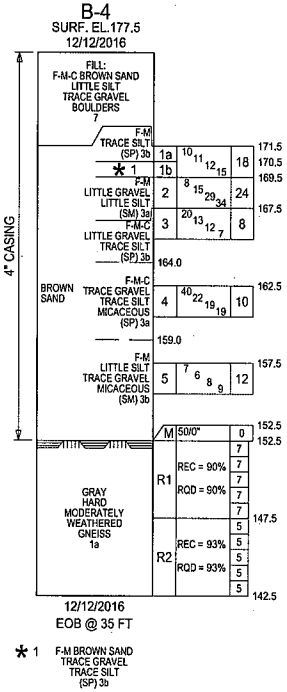
30 0 30

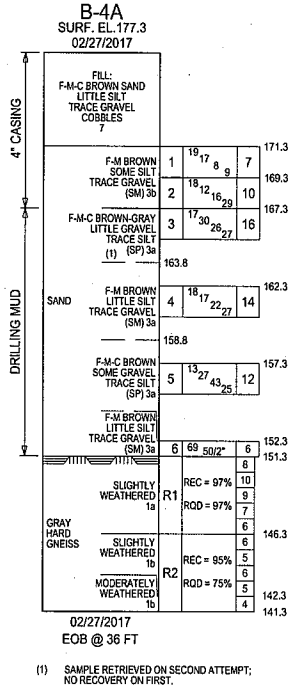
LEGEND

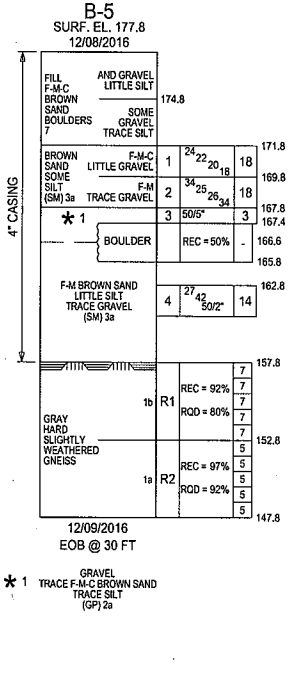
- TEST BORING
- TEST BORING WITH OBSERVATION WELL

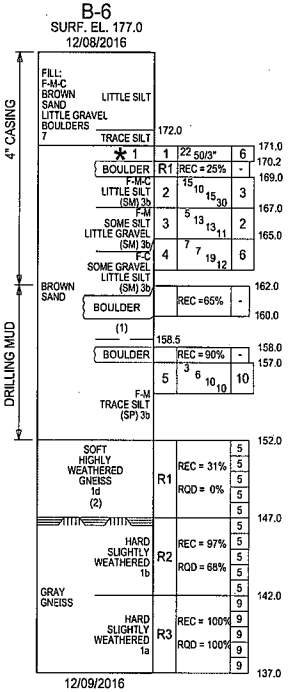


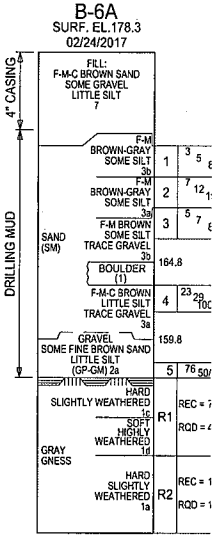












LABORATORY ANALYSIS OF SOILS*

Sample Identification And Index Properties																		Rock Tests	
BORING NO.	SAMPLE NO.	DEPTH, ft	D100, mm	D60, mm	D30, mm	D10, mm	% GRAVEL (> #4 SIEVE)	% SAND	% SILT OR CLAY (< #200 SIEVE)	WC %	Cc	Cu	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX	pH	ORGANIC CONTENT (%)	USCS SYMBOL	Test Type	Unconfined Compressive Stress (psi)
B-1	1	6-8	-	0.34	0.10	-	12.9	62.5	24.6	-	-	-	-	-	-	-	-	SM	-	-
B-1	2	8-10	-	0.31	0.13	-	1.3	79.9	18.8	-	-	-	-	-	-	-	-	SM	-	-
B-1	R1	10-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	UCS	16,038
B-2	1	6-8	-	0.37	0.14	-	6.2	73.2	20.6	-	-	-	-	-	-	-	-	SM	-	-
B-2	3	10-12	-	0.48	0.13	-	18.0	62.0	20.0	-	-	-	-	-	-	-	-	SM	-	-
B-3	2	8-10	-	0.52	0.16	-	7.1	74.8	18.1	-	-	-	-	-	-	-	-	SM	-	-
B-3	4	15-17	-	0.29	0.12	-	9.0	71.1	19.9	-	-	-	-	-	-	-	-	SM	-	-
B-4	1b	6-8	-	1.00	0.50	0.18	6.5	89.2	4.3	-	1.39	5.51	-	-	-	-	-	SP	-	-
B-4	5	20-22	-	0.32	0.12	-	4.5	76.8	18.7	-	-	-	-	-	-	-	-	SM	-	-
B-4A	1	6-8	-	0.31	0.09	-	7.9	65.8	26.3	-	-	-	-	-	-	-	-	SM	-	-
B-4A	6	25-25.7	-	0.33	0.15	-	3.3	81.2	15.5	-	-	-	-	-	-	-	-	SM	-	-
B-5	2	8-10	-	0.30	0.08	-	8.7	63.3	28.0	-	-	-	-	-	-	-	-	SM	-	-
B-5	4	15-17	-	0.41	0.17	-	5.8	81.4	12.8	-	-	-	-	-	-	-	-	SM	-	-
B-6	1	6-8	-	0.35	0.11	-	7.9	67.6	24.5	-	-	-	-	-	-	-	-	SM	-	-
B-6	3	10-12	-	0.42	0.11	-	16.1	60.4	23.5	-	-	-	-	-	-	-	-	SM	-	-
B-6A	3	10-12	-	0.30	0.09	-	4.4	68.2	27.4	15.5	-	-	NV	NP	NP	-	-	SM	-	-
B-6A	5	20-20.7	-	28.82	1.22	-	58.6	31.4	10.0	-	-	-	-	-	-	-	-	GP-GM	-	-

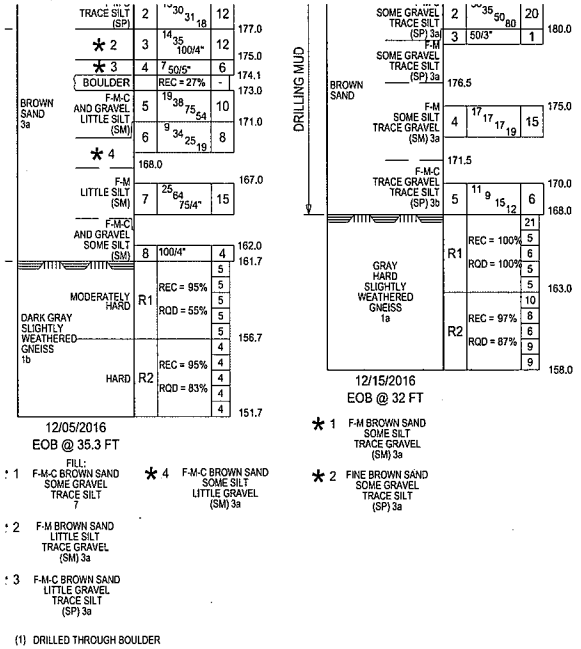
NYC DDC Department of Design and Construction

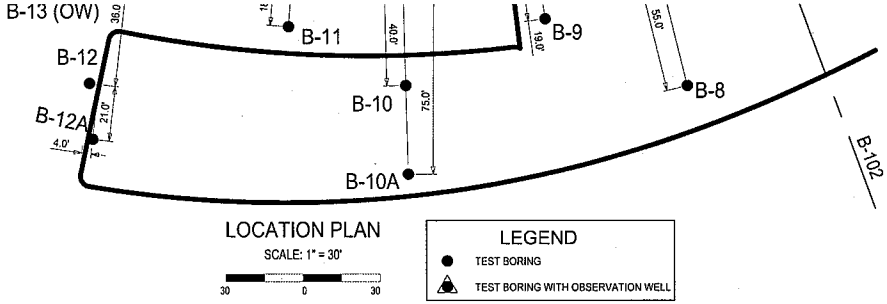
HED-CLUB

4069A

CONSULTANT NAME:
CDM SMITH
14 WALL STREET, SU
NEW YORK, NEW YOR

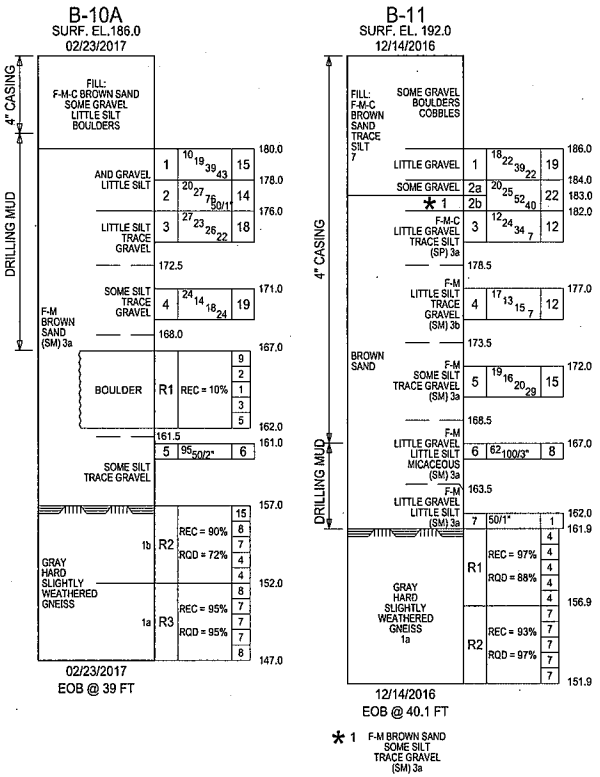
PROJECT NAME:
CROTON WA





LOCATION PLAN
SCALE: 1" = 30'

LEGEND
- TEST BORING
- TEST BORING WITH OBSERVATION WELL



LABORATORY ANALYSIS OF SOILS*

ample Identification And Index Properties

D10, mm	% GRAVEL (> #4 SIEVE)	% SAND	% SILT OR CLAY (< #200 SIEVE)	WC %	Cc	Cu	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX	pH	ORGANIC CONTENT (%)	USCS SYMBOL	Rock Tests: Test Type	Rock Tests: Unconfined Compressive Stress (psi)
-	27.5	47.4	25.1	-	-	-	-	-	-	-	-	SM	-	-
-	25.2	59.6	15.2	-	-	-	-	-	-	-	-	SM	-	-
-	7.4	73.4	19.2	-	-	-	-	-	-	-	-	SM	-	-
-	0.0	81.0	19.0	19.8	-	-	NV	NP	NP	-	-	SM	-	-
-	2.1	66.0	31.9	-	-	-	-	-	-	-	-	SM	-	-
-	7.7	65.1	27.2	-	-	-	-	-	-	-	-	SM	-	-
-	36.6	48.0	15.4	-	-	-	-	-	-	-	-	SM	-	-
-	1.3	78.0	20.7	-	-	-	-	-	-	-	-	SM	-	-
-	6.4	66.5	27.1	-	-	-	-	-	-	-	-	SM	-	-
-	2.1	72.7	25.4	-	-	-	-	-	-	-	-	SM	-	-
-	23.0	52.5	24.5	-	-	-	-	-	-	-	-	SM	-	-
-	0.9	74.5	24.6	-	-	-	-	-	-	-	-	SM	-	-
-	3.7	72.8	23.5	13.5	-	-	NV	NP	NP	-	-	SM	-	-
-	26.3	51.9	21.8	-	-	-	-	-	-	-	-	SM	-	-
-	1.9	70.4	27.7	-	-	-	-	-	-	-	-	SM	-	-

NYC DDC Department of Design and Construction

HED-CLUB
4069A

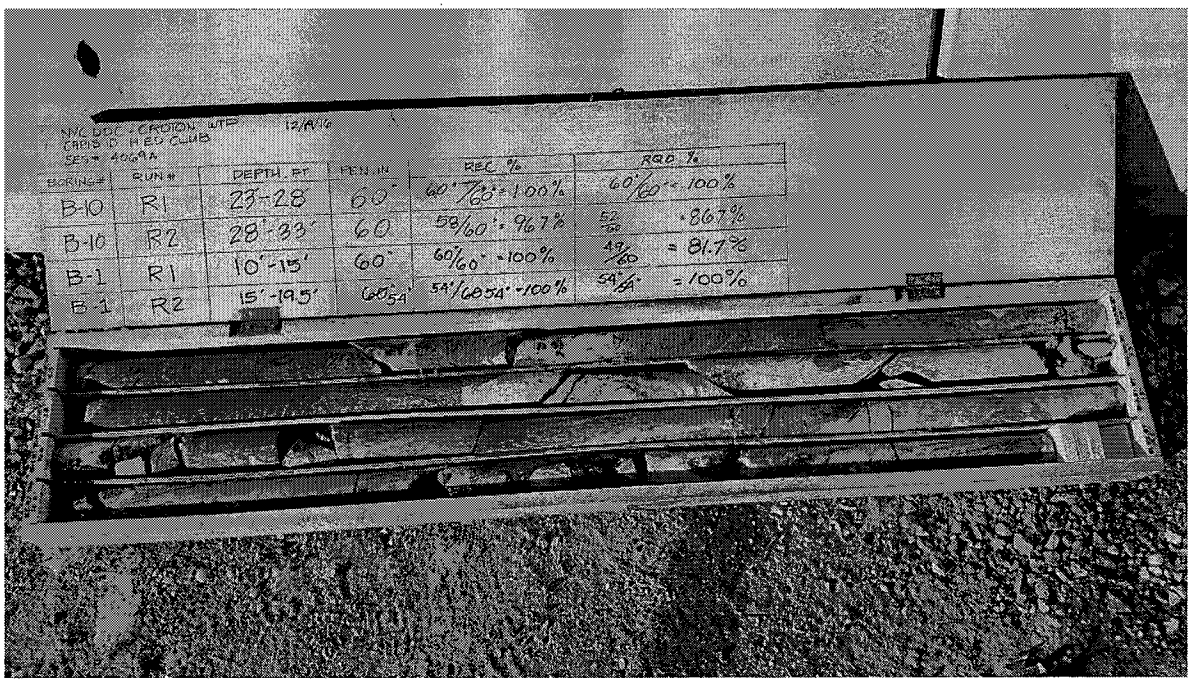
CONSULTANT NAME:
CDM SMITH
14 WALL STREET, SU
NEW YORK, NEW YO

PROJECT NAME:
CROTON WA

ROCK CORE PHOTOGRAPHIC LOGS

DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

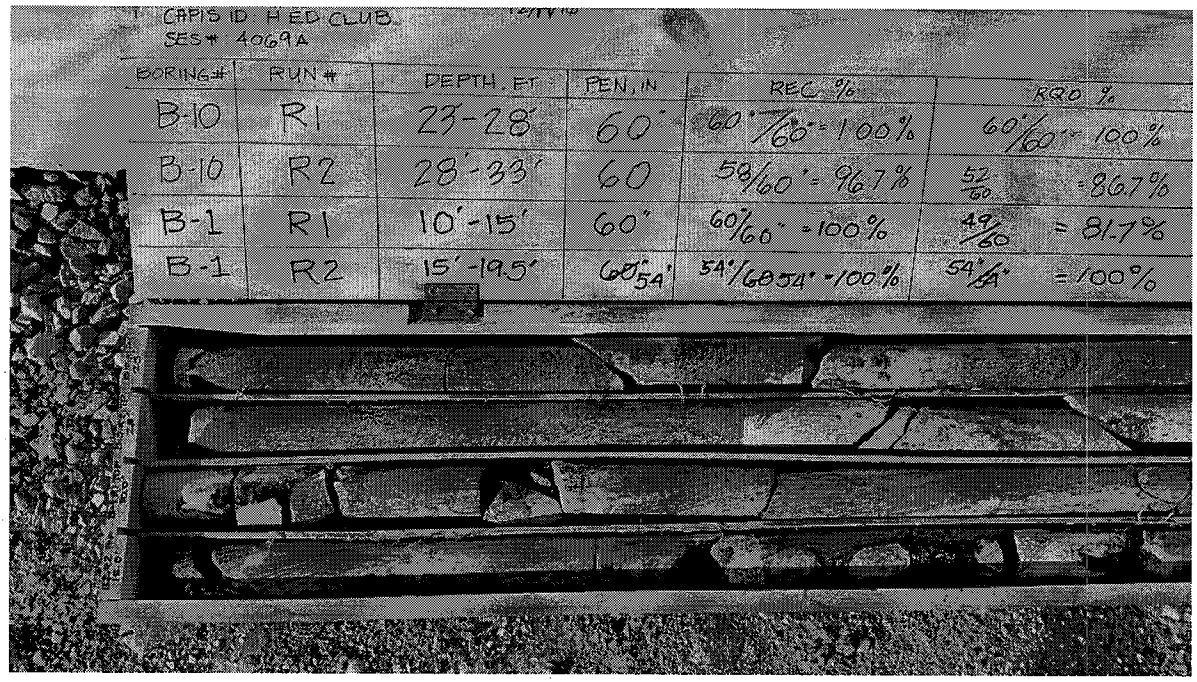
Boring No.	
B-1	R-1
	R-2
B-10	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

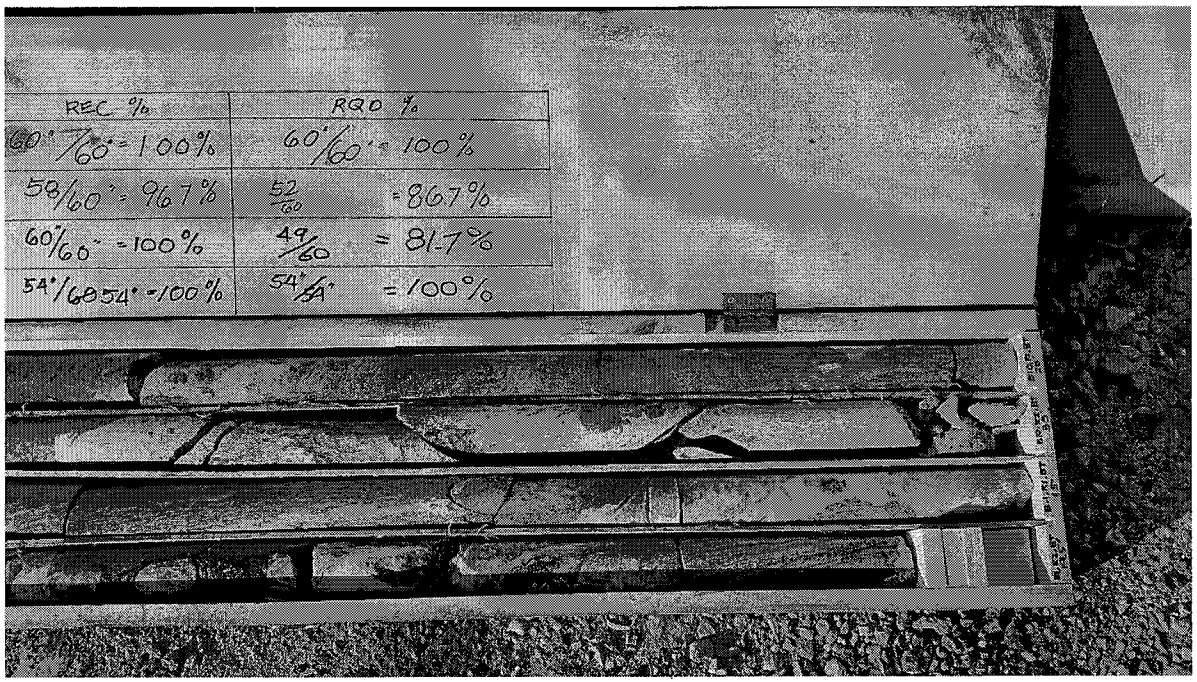
CDM Smith

Boring No.	
B-1	R-1
	R-2
B-10	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-1	R-1 R-2
B-10	R-1 R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

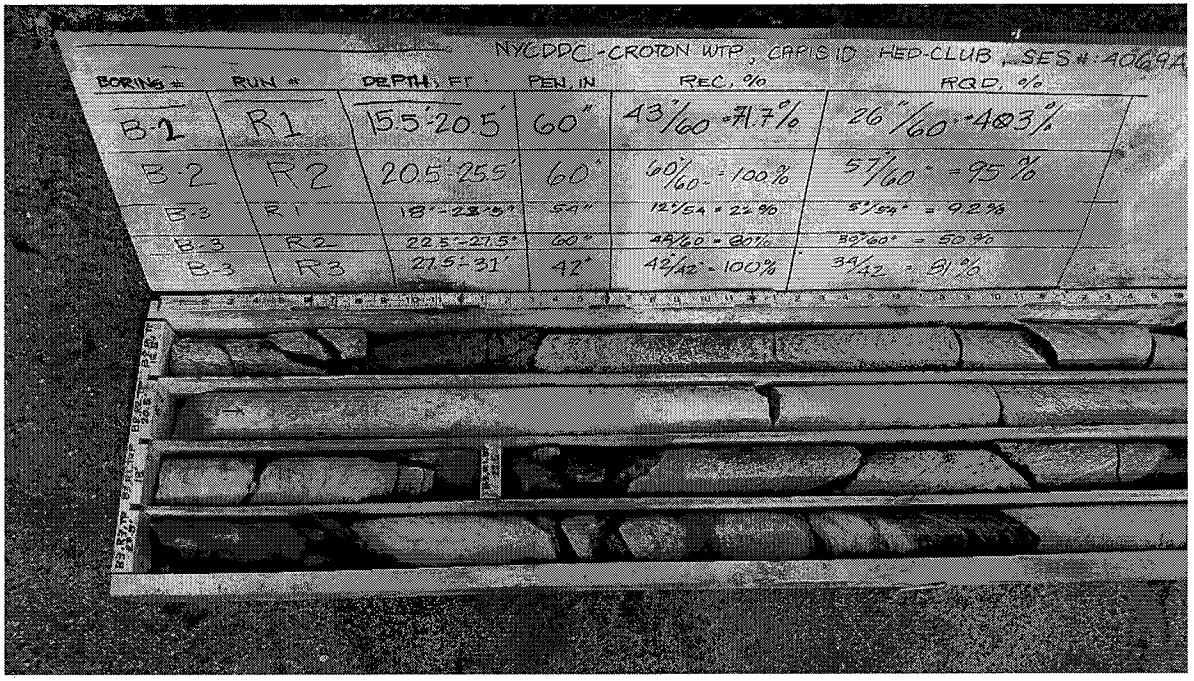
CDM Smith

Boring No.	
B-2	R-1
	R-2
B-3	R-1
	R-2
	R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-2	R-1
	R-2
B-3	R-1
	R-2
	R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

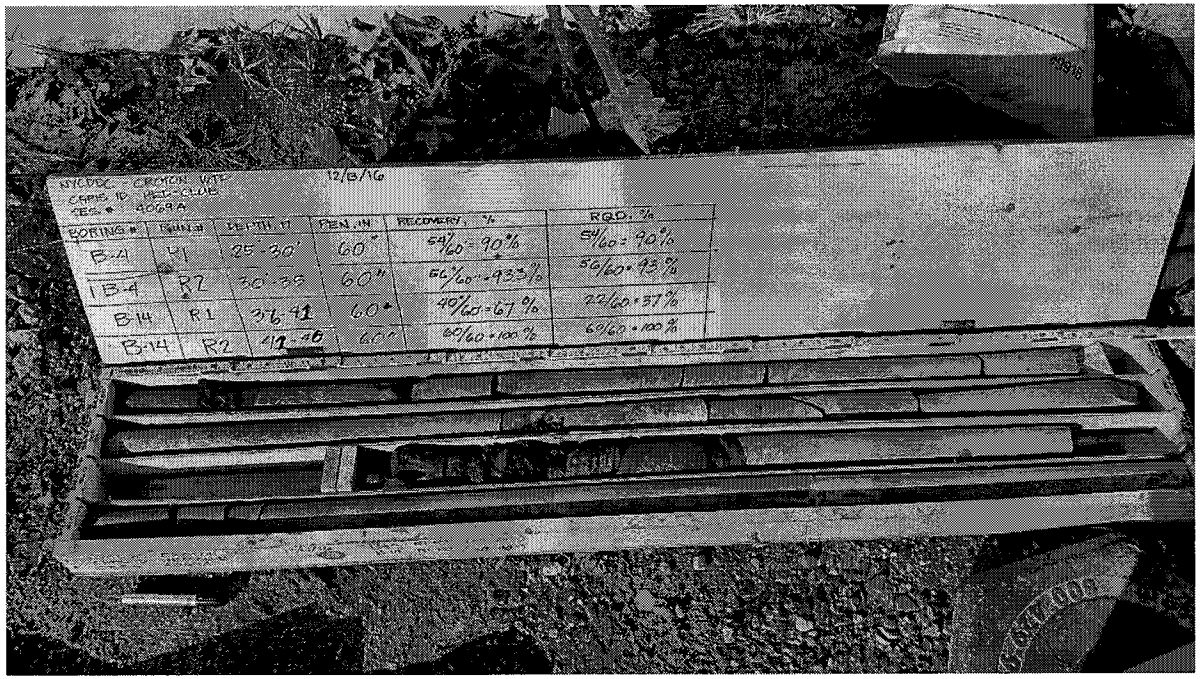
CDM Smith

Boring No.	
B-2	R-1
	R-2
B-3	R-1
	R-2
	R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**
	CDM Smith

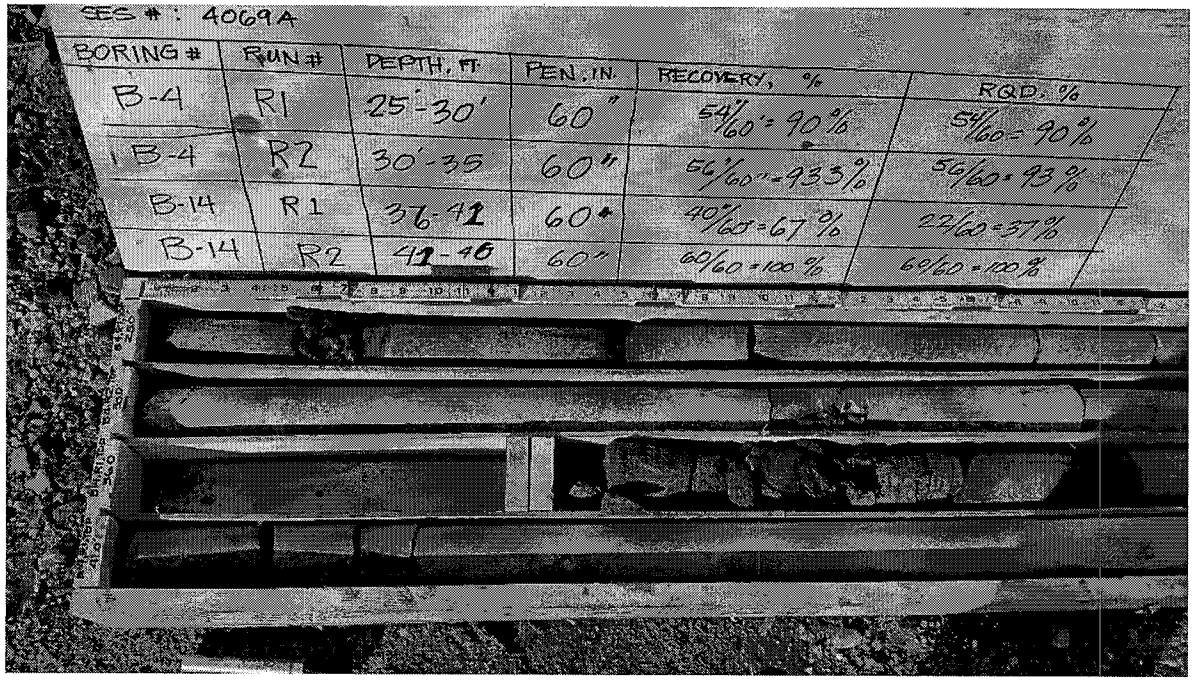
Boring No.	
B-4	R-1
	R-2
B-14	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

Boring No.	
B-4	R-1
	R-2
B-14	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

Boing No.	
B-4	R-1
	R-2
B-14	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

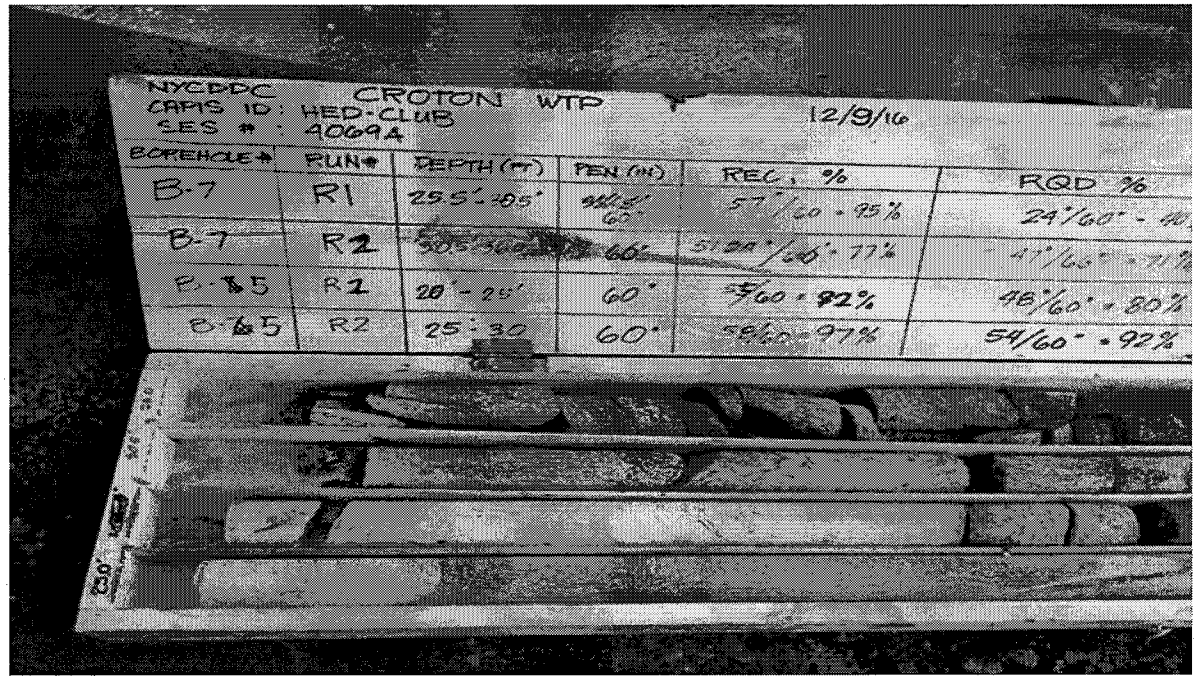
CDM Smith

Boring No.	
B-5	R-1
	R-2
B-7	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-5	R-1
	R-2
B-7	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**

NYC DDC Department of Design and Construction

Project Name: **Croton Water Treatment Plant**
Location: **3701 Jerome Avenue, The Bronx, NY**
SES No.: **4069A**

CDM Smith

Boring No.	
B-5	R-1
	R-2
B-7	R-1
	R-2



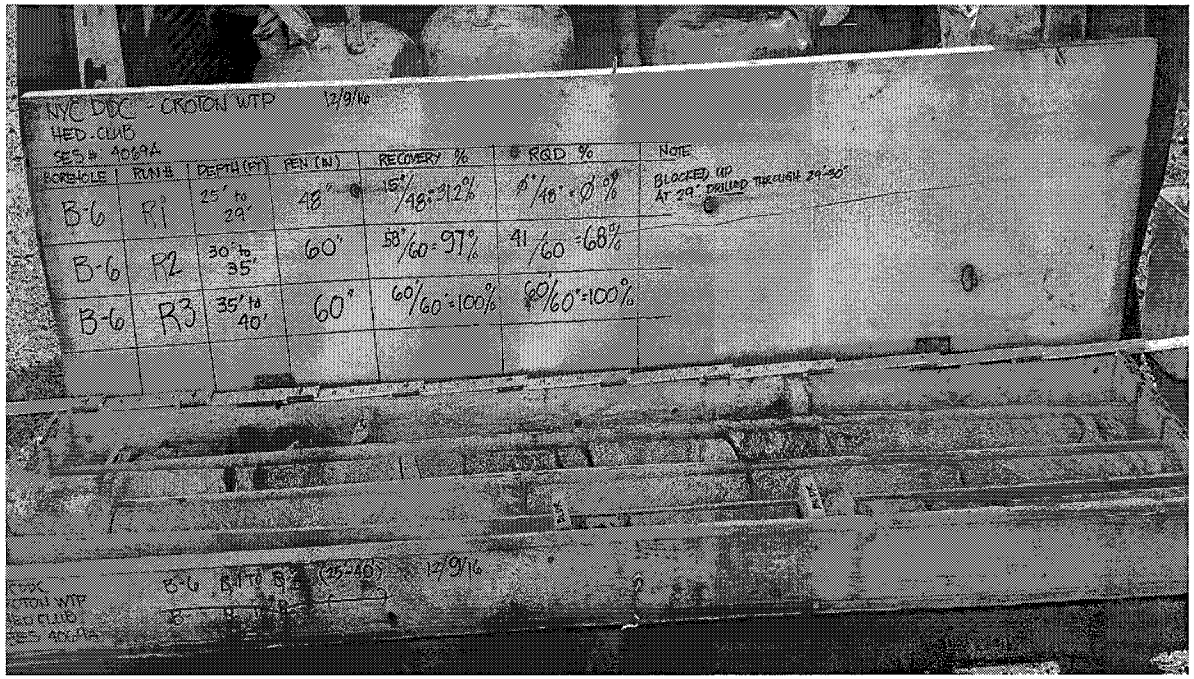
DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**

NYC DDC Department of Design and Construction

Project Name: **Croton Water Treatment Plant**
Location: **3701 Jerome Avenue, The Bronx, NY**
SES No.: **4069A**

CDM Smith

Boring No.	
B-6	R-1 R-2 R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

Boring No.	
B-6	R-1 R-2 R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**

Department of Design and Construction

Project Name: **Croton Water Treatment Plant**
Location: **3701 Jerome Avenue, The Bronx, NY**
SES No.: **4069A**

CDM Smith

Boring No.	
B-6	R-1 R-2 R-3



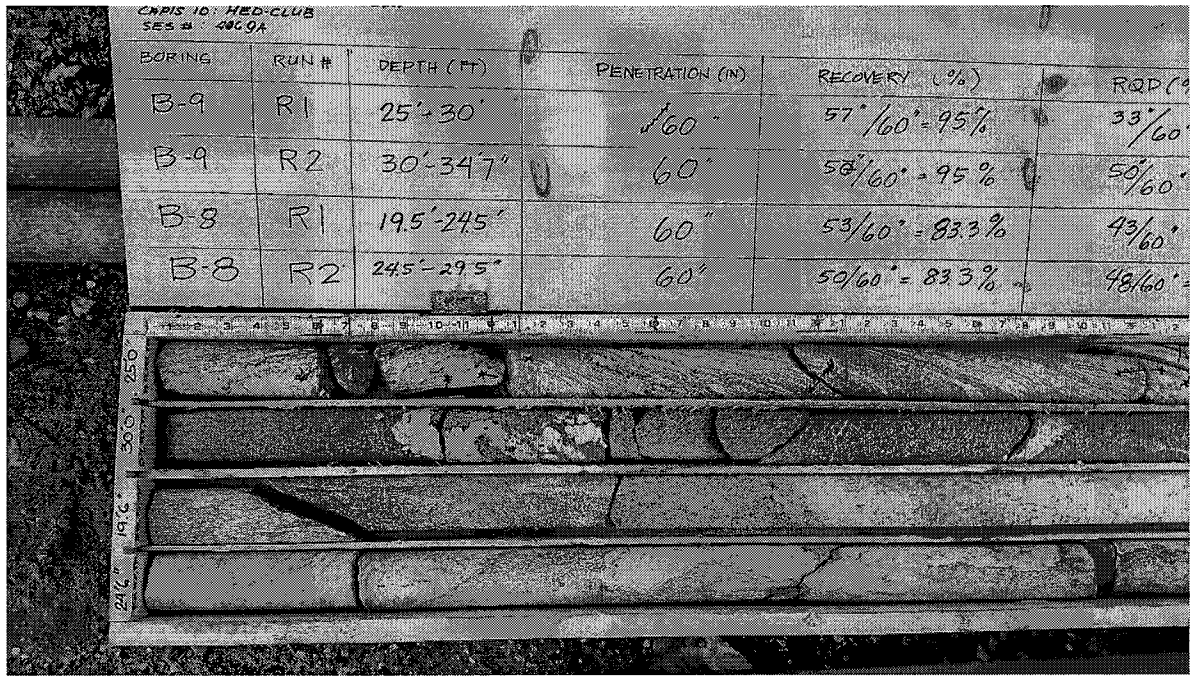
DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-8	R-1
	R-2
B-9	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**
	CDM Smith

Boring No.	
B-8	R-1
	R-2
B-9	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

Boring No.	
B-8	R-1
	R-2
B-9	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**
	CDM Smith

Boring No.	
B-11	R-1
	R-2
B-13	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-11	R-1
	R-2
B-13	R-1
	R-2



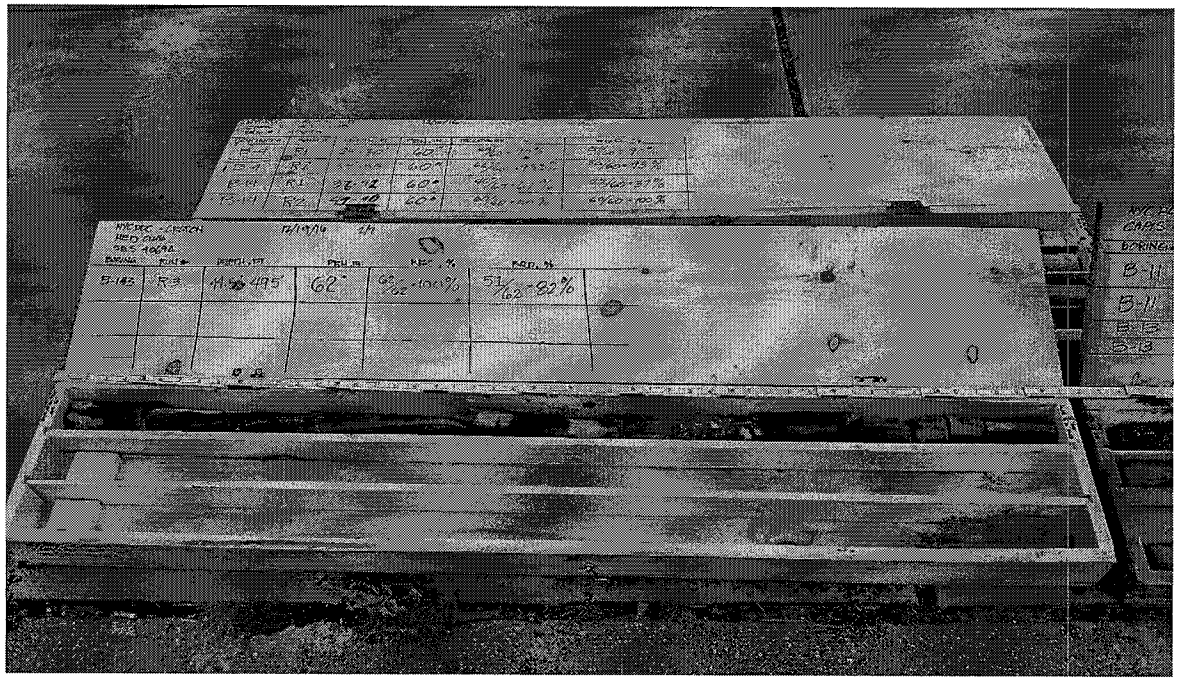
DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**
	CDM Smith

Boring No.	
B-11	R-1
	R-2
B-13	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-13	R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

Boring No.	
B-13	R-3



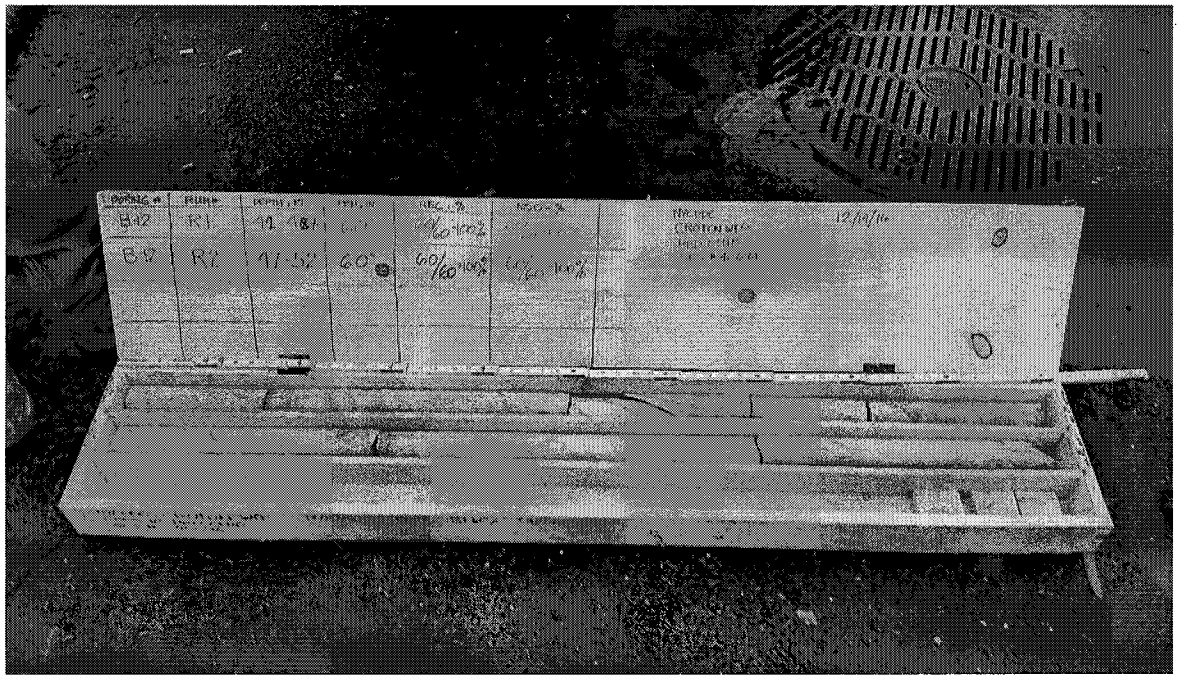
DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**
	CDM Smith

Boring No.	
B-13	R-3



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**
	CDM Smith

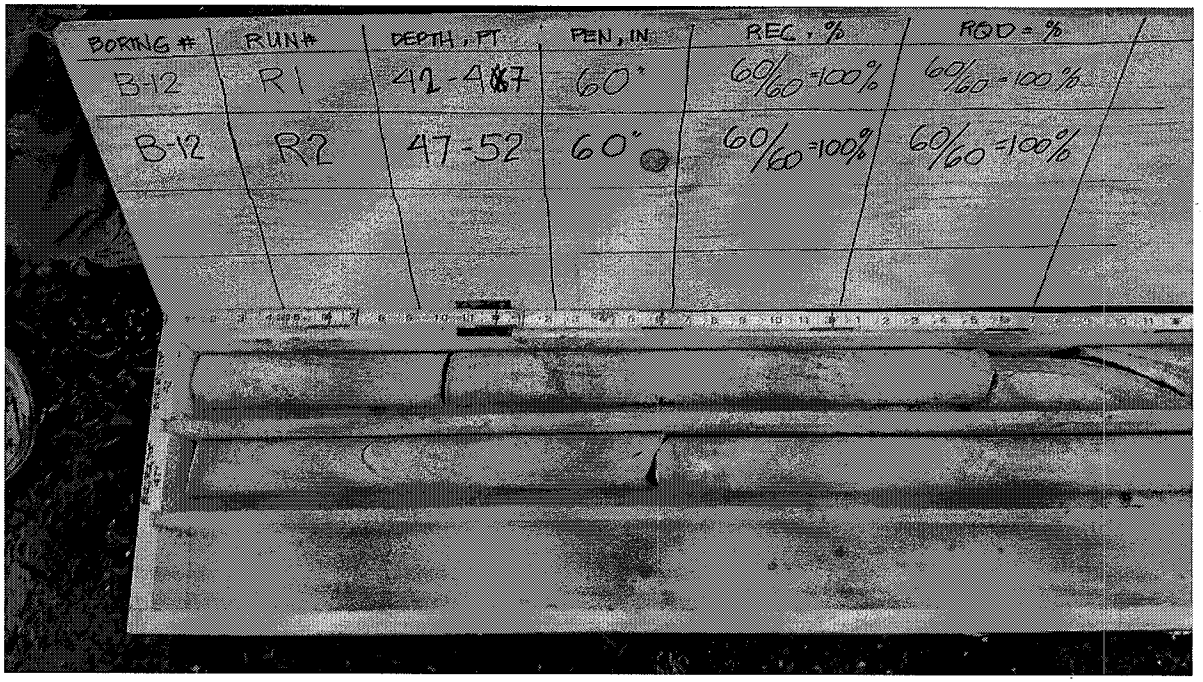
Boring No.	
B-12	R-1 R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

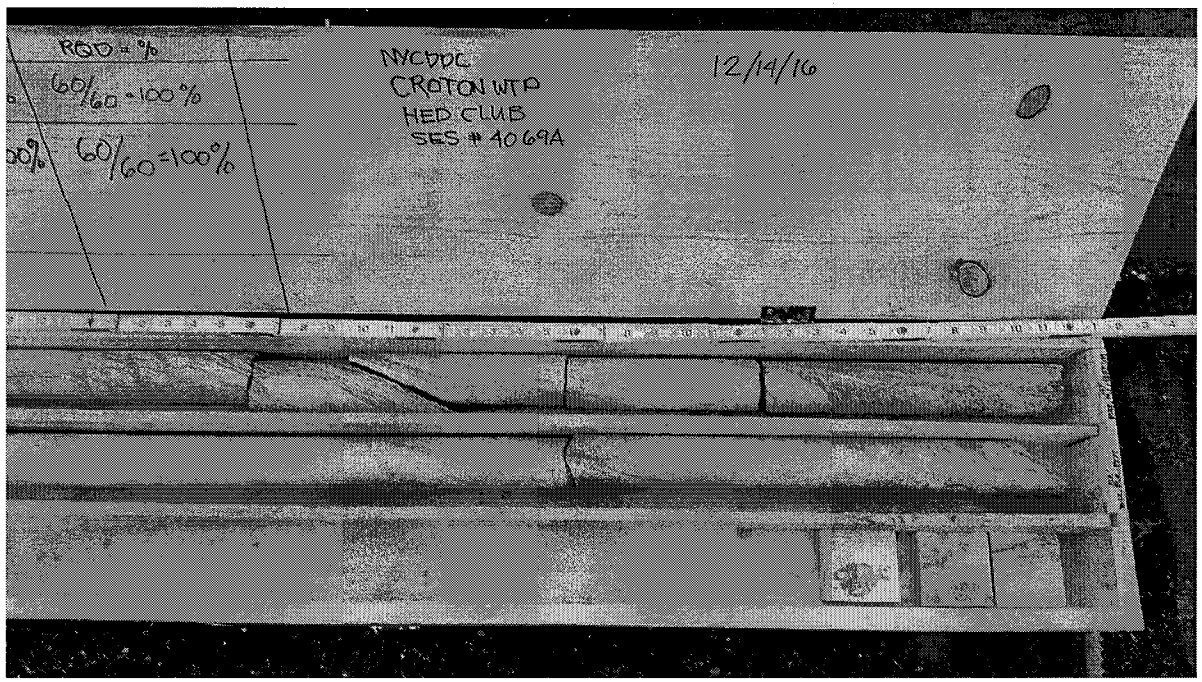
Boring No.	
B-12	R-1 R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

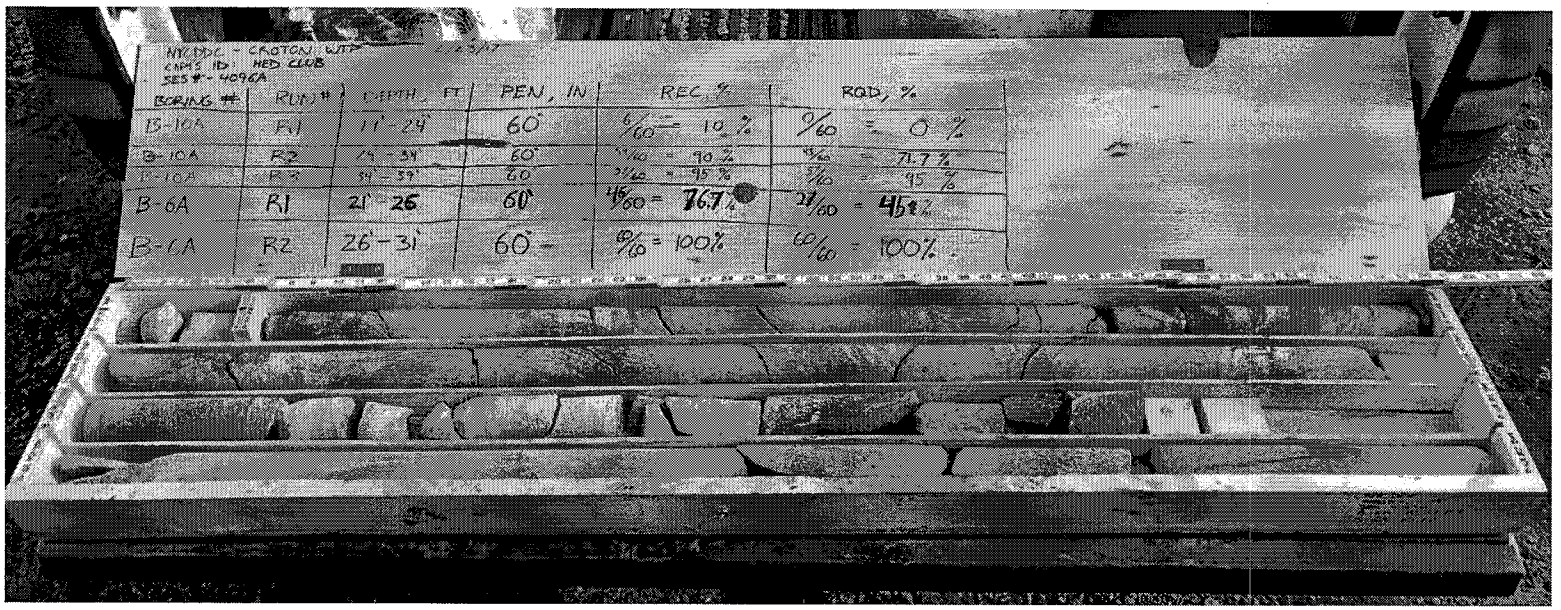
CDM Smith

Boring No.	
B-12	R-1 R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-10A	R-1
	R-2
	R-3
B-6A	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-10A	R-1
	R-2
	R-3
B-6A	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

CDM Smith

Boring No.	
B-10A	R-1
	R-2
	R-3
B-6A	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-4A	R-1
	R-2
B-12A	R-1
	R-2



DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-4A	R-1
	R-2
B-12A	R-1
	R-2

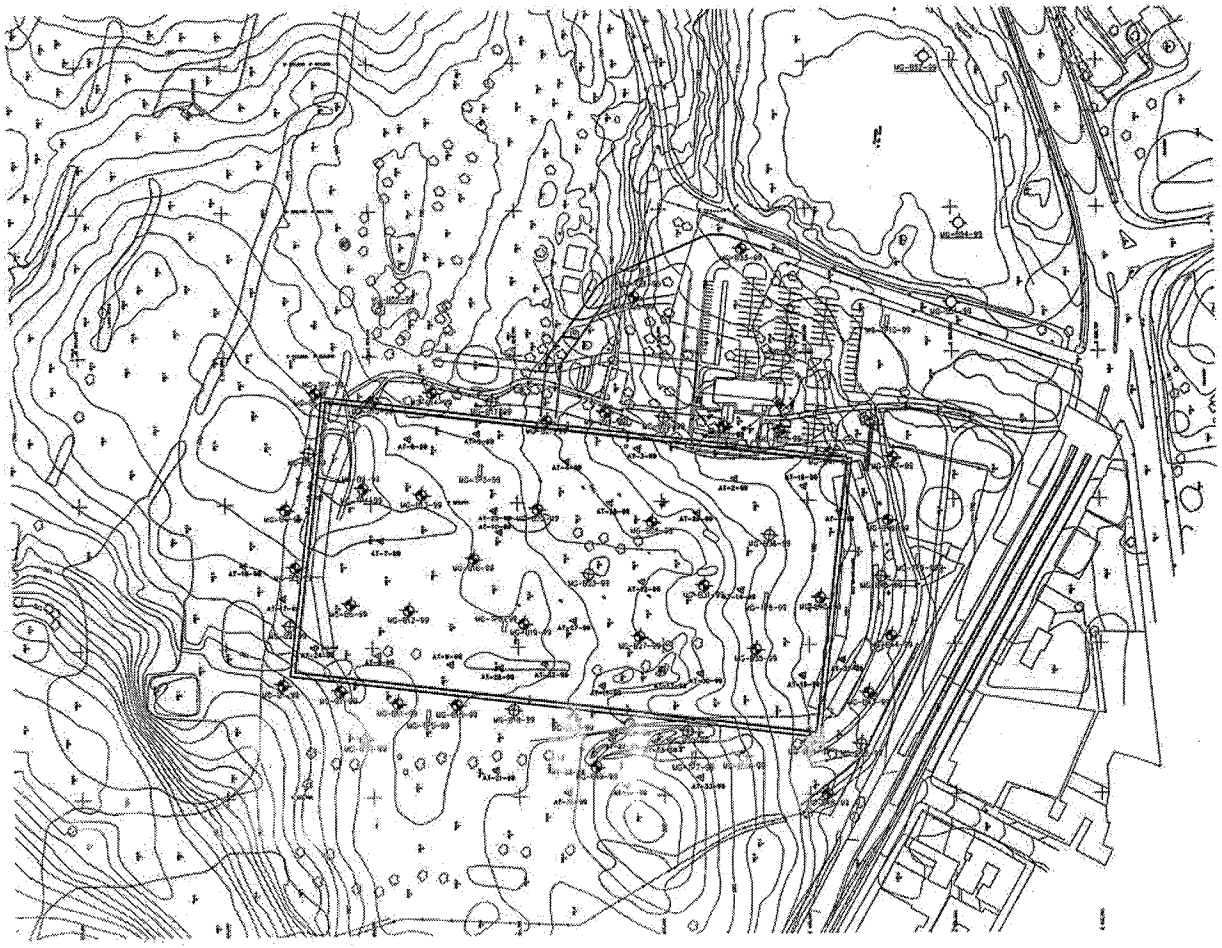


DDC Project No: **HED-CLUB**	**ROCK CORE PHOTOGRAPHIC LOG**
NYC DDC Department of Design and Construction	Project Name: **Croton Water Treatment Plant** Location: **3701 Jerome Avenue, The Bronx, NY** SES No.: **4069A**

Boring No.	
B-4A	R-1
	R-2
B-12A	R-1
	R-2



Appendix B – 2000 Boring Logs



LEGEND

- TEST BORING
- PIEZOMETER
- MONITORING WELL
- AIR-TRACK BORING
- TEST PIT

NOTES:
1. CONTOURS AND BORING LOCATIONS ARE BASED UPON THE TOPOGRAPHIC SURVEY CONDUCTED FOR THE 1999 SUBSURFACE INVESTIGATION.

0 100 200 300
SCALE IN FEET
SCALE: 1"=100'

NUMBER	DATE	MADE BY	CHECKED BY	DESCRIPTION

REVISIONS

M&E Metcalf & Eddy of New York, Inc. An AB & Water Technologies Company — A JOINT VENTURE

HAZEN AND SAWYER Environmental Engineers & Scientists

SCALE: AS NOTED

THE CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION

CROTON WATER TREATMENT PLANT
AT MOSHOLU GOLF COURSE
VAN CORTLANDT PARK, BRONX, NY

TEST BORING, AIR TRACK BORING, AND TEST PIT
LOCATION PLAN

DATE NOVEMBER 2000
CONTRACT HED-543
SHEET 1-1

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B43-99
LINE & STA. N:322,918.19
OFFSET E:625,351.04

DEPTH ____ FT ____ FT. CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE START: 1-28-99
DATE FINISH: 1-29-99

GROUND ELEVATION 174.84
GROUND WATER ELEVATION 169.62 2/11/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	10"	3	3	4	4		0'-2'	TOPSOIL (3"). DARK BROWN SILTY SAND, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-4'	12"	4	8	7	20		4'	DARK BROWN SILT WITH SAND. STIFF. (ML) (11-65)
		SS3	4'-6'	8"	14	20	16	21			
		SS4	6'-8'	10"	15	16	17	17			
10		SS5	8'-10'	3"	100	/3"				11'	RUSTY BROWN SILTY FINE SAND, SOME GRAVEL, COBBLES. (SP-SM AND GP-GM) (6-65)
		SS6	10'-12'	10"	17	20	45	45			
		SS7	12'-14'	6"	12	15	16	15			
		SS8	14'-16'	8"	21	19	33	45		17'	YELLOW BROWN SILTY F-M SAND, WITH GRAVEL, MICA, ROCK FRAGMENTS (GNEISS), COBBLES. DENSE TO VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED) ROCK). (SM AND GM) (6-65/5-65)
		SS3	16'-17'	2"	100	/2"					
20											
		R1	17.5'-27.5'	98% REC 85% RQD							GNEISS. MEDIUM GRAY. SLIGHTLY SCHISTOSE FROM 35' TO 51'. FOLIATION FROM 50 DEGREES TO SUBVERTICAL. QUARTZ BAND FROM 47' TO 48'. OXIDATION ON JOINTS TO 45.5'. FROM 22' TO 23.8', A SUBVERTICAL FOLIATION JOINT, OXIDIZED, SMOOTH, OPEN WITH FOUR 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, OPEN.
30											
		R2	27.5'-37.5'	98% REC 86% RQD							
		R3	37.5'-40.5'	96% REC 78% RQD							
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B43-99
LINE & STA. N:322,918.19
OFFSET E:625,351.04

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE START: 1-28-99
DATE FINISH: 1-29-99

GROUND ELEVATION 174.84
GROUND WATER ELEVATION 169.62 2/1/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0										
40										
50										
10	R4	40.5'-50.5'	98% REC 84% RQD							
	R5	50.5'-56'	100 % REC 100 % RQD						56'	
60 20										
70										
30										
80										
40										

FROM 24.5' TO 25.2' AND 25.4' TO 26.25', TWO SUB-VERTICAL FOLIATION JOINTS, SMOOTH, TIGHT.
FROM 31' TO 32.5', FRACTURED ZONE, SOFT, FRIABLE.
FROM 30.6'TO 31.1' AN 80-DEGREE FOLIATION JOINT, ROUGH, OPEN.
FROM 32' TO 32.5', A 70-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, ROUGH.
FROM 33.75' TO 34.1', A 70-DEGREE FOLIATION JOINT, OXIDIZED, SMOOTH, TIGHT.
FROM 34.1'TO 34.8' A 70-DEGREE JOINT ACROSS FOLIATION, OXIDIZED, ROUGH, WTIH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT.

ROCK QUARTZITE IMPROVES FROM 35' TO 38.2'. CLOSELY JOINTED FROM 38.2' TO 42.1'. FROM 38.2' TO 38.9' A FOLIATION JOINT, OXIDIZED, SMOOTH, TIGHT WITH A 10-DEGREE JOINT ACROSS

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B43-99
LINE & STA. N:322,918.19
OFFSET E:625,351.04

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE START: 1-28-99
DATE FINISH: 1-29-99

GROUND ELEVATION 174.84
GROUND WATER ELEVATION 169.62 2/11/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											FOLIATION, ROUGH.
											FOLIATION JOINTS BELOW 41' ARE SMOOTH, TIGHT. IN GENERAL GOOD ROCK FROM 17' TO 42.1'. (2-65)
10											ROCK QUALITY IMPROVES BELOW 42.1'. (1-65)
											END OF HOLE 56'
20											
30											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B44-99
LINE & STA. N:323,014.73
OFFSET E:625,391.41

DEPTH ____ FT. ____ FT. CASING OUT DATE ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-4-99
DATE. FINISH: 2-5-99

GROUND ELEVATION 174.13
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER ____ LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
									0'-	ANGLED BOREHOLE DIRECTION: N 82 DEGREES W ANGLE: 60 DEGREE ROLLER BIT TO TOP OF ROCK NOTE: ALL DEPTHS SHOWN AS "DOWN-HOLE" OR NON-VERTICAL
	R1	19'-22'	99% REC 55% RQD						19'	GNEISS. LIGHT TO MEDIUM GRAY, SCHISTOSE. FOLIATION AT 30 DEGREES TO SUB-VERTICAL. OXIDATION ON JOINTS TO 25'. CLOSE JOINT SPACING TO 21'. (3-65) MODERATELY CLOSE SPACING FROM 21' TO 96.25'. ROUGH FOLIATION JOINTS PREDOMINATE FROM 19' TO 22' AND BELOW 72'.
	R2	22'-32'	99% REC 91% RQD							

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 3
LOCATION BRONX, NY
HOLE NO. MG-B44-99
LINE & STA. N:323,014.73
OFFSET E:625,391.41

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE. START: 2-4-99
DATE. FINISH: 2-5-99

GROUND ELEVATION 174.13
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER ____ LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R3	32'-42'	99% REC 96% RQD							GENERALLY SMOOTH FOLIATION JOINTS FROM 32' TO 72'. A 50-DEGREE JOINT ACROSS FOLIATION AT 87.5'. AT 93.8', A SUB-VERTICAL FOLIATION JOINT, ROUGH, WITH A 10-DEGREE JOINT ACROSS FOLIATION, ROUGH, TIGHT. FROM 95.25' TO 95.75', A SMOOTH SUBVERTICAL JOINT WITH FOLIATION TREND, WITH 20-DE-GREE JOINT ACROSS FOLIATION, TIGHT, ROUGH. CLOSELY TO MODERATELY JOINTED FROM 96.25' TO 100.9'. MODERATELY CLOSE JOINT SPACING BELOW 100.9'. FROM 96.25' TO 98.25', A SMOOTH 80-DEGREE JOINT ACROSS FOLIATION, TIGHT, WITH FOUR 10-DEGREE JOINTS ACROSS FOLIATION, ROUGH, TIGHT. A SUBVERTICAL FOLIATION JOINT FROM 98.5' TO 99'.
50											
10		R4	42'-52'	99% REC 78% RQD							
60											
20		R5	52'-62'	99% REC 98% RQD							
70											
30		R6	62'-72'	99% REC 90% RQD							
80											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 3 OF 3
LOCATION BRONX, NY
HOLE NO MG-B44-99
LINE & STA. N:323,014.73
OFFSET E:625,391.41

DEPTH ____ FT ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE ____

DATE START: 2-4-99
DATE FINISH: 2-5-99

GROUND ELEVATION 174.13
GROUND WATER ELEVATION ____

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER ____ LBS.
INSIDE LENGTH OF SAMPLER ____ IN.

HAMMER FALL
CASING ____ SAMPLER ____

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
80		R7	72'-82'	99% REC 93% RQD							IN GENERAL, THE ROCK IS GOOD BELOW 21'. (1-65)
90											
10											
		R8	82'-92'	99% REC 98% RQD							
100											
20											
		R9	92'-102'	99% REC 73% RQD							
		R10	102'-105'	99% REC 99% RQD						105'	
110											END OF HOLE 105'
30											
120											
40											

Soil Engineer: ____ Driller: GREG MARNEY

Drilling Inspector: ____ Helper: GREG WILLIAMS

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B45-99
LINE & STA. N:323,116.78
OFFSET E:625,374.89

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE: ____

DATE START: 2-8-99
DATE FINISH: 2-10-99

GROUND ELEVATION 176.79
GROUND WATER ELEVATION 168.24 3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	18"	12	14	15	17		0'-2'	TOPSOIL(3). DARK GRAY SILT WITH SAND, ORGANIC MATTER. (ML)(11-65)
		SS2	2'-4'	18"	4	5	5	6		4'	RUSTY BROWN SILTY FINE SAND. (SM) (7-65)
		SS3	4'-6'	18"	10	11	11	11		6'	DARK GRAY SILT WITH FINE SAND. (ML) (11-65)
		SS4	6'-8'	18"	5	6	9	8		8'	YELLOW BROWN SILTY F-M SAND. MEDIUM DENSE. (SM) (7-65)
		SS5	8'-8.1'	NR	100/1"					14.5'	POSSIBLE SAFROLITIC SOIL. BOULDERS. DENSE. (SM AND GM) (6-65/5-65)
10		SS6	10'	NR	100/0"						
		R1	14.5'-19.5'	93% REC 81% RQD							GNEISS. MEDIUM GRAY. SLIGHTLY WEATHERED TO UN-WEATHERED. FOLIATION FROM 60 TO 80 DEGREES. OXIDATION ON JOINTS TO 20.5', AT 38' AND 49.5'. A 70 DEGREE FOLIATION JOINT, OXIDIZED, FROM 16.8' TO 17.4'. CLOSELY JOINTED FROM 16' TO 18.5', 31.6' TO 38', 45' TO 50'. MODERATELY CLOSE JOINT SPACING IN THE REST OF THE CORE. (2-65/1-65)
20		R2	19.5'-21.5'	99% REC 98% RQD							
		R3	21.5'-22.5'	68% REC 68% RQD							
30		R4	22.5'-32.5'	96% REC 93% RQD							
40											

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED 543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B45-99
LINE & STA. N:323,116.78
OFFSET E:625,374.89

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT ALL CASING OUT DATE: ____

DATE, START: 2-8-99
DATE, FINISH: 2-10-99

GROUND ELEVATION 176.79
GROUND WATER ELEVATION 168.24
3/24/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40		R5	32.5'-42.5'	99% REC 80% RQD							
50											
10		R6	42.5'-50'	99% REC 77% RQD							
		R7	50'-55'	99% REC 99% RQD						55'	
60											END OF HOLE 55' ORIENTED CORE FROM 20' TO 55'. WATER PRESSURE TESTS IN ROCK FROM 15' TO 55'. PIEZOMETER INSTALLED AT 53'.
20											
70											
30											
80											
40											

Soil Engineer: ____ Driller: CESAR MORIERA

Drilling Inspector: ____ Helper: MIKE KELLY

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B46-99
LINE & STA. N:323,215.85
OFFSET E:625,387.39

DEPTH ____ FT. ____ FT. CASING OUT DATE. ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 1-25-99
DATE. FINISH: 1-26-99

GROUND ELEVATION 175.44
GROUND WATER ELEVATION 166.62 2/1/99

CASING O.D. HW I.D ____
SAMPLER O.D. 2" I.D ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV. / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	8"	8	8	9	14		0'-2'	TOPSOIL (1.5"). DARK GRAY SILTY SAND, ORGANIC MATTER. MEDIUM DENSE. (SM) (11-65)
		SS2	2'-4'	18"	7	10	12	21		6'	RUSTY BROWN SILTY F-M SAND, TRACE GRAVEL, COBBLES (SM) (6-65)
		SS3	4'-6'	2"	38	56	69	100			
		SS4	6'-7'	9"	28	100	/3"				
10		R1	7.5'-12.5'	17%	REC	BOU	LDE	RS			YELLOW BROWN SILTY F-M SAND, MICA, ROCK FRAGMENTS (GNIESS), COBBLES AND BOULDERS. POSSIBLE SAPROLITIC SOIL. (SM AND GM) (6-65/5-65)
		R2	12.5'-13.5'	50%	REC	BOU	LDE	RS			
		SS5	13.5'-14'	6"	100	/6"				14'	
20		R3	15.5'-20'	100 %		REC					GNEISS. MEDIUM GRAY. QUARTZITIC FROM 39' TO 45', 48' TO 50'. FOLIATION AT 70 DEGREES TO SUB-VERTICAL. OXIDATION ON JOINTS UP TO 37.5'. FROM 15.75' TO 16.5', A 70-DEGREE FOLIATION JOINT, SLIGHTLY OXIDIZED, SMOOTH. FROM 22.8' TO 24.3', AN 80-DEGREE FOLIATION JOINT, OXIDIZED, ROUGH.
				98%	RQD						
30		R4	20'-30'	98%	REC						
				93%	RQD						
40		R5	30'-40'	100 %		REC					
				96%	RQD						

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.

SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 2 OF 2
LOCATION BRONX, NY
HOLE NO. MG-B46-99
LINE & STA. N:323,215.85
OFFSET E:625,387.39

DEPTH ____ FT. ____ FT. CASING OUT DATE: ____
DEPTH ____ FT. ALL CASING OUT DATE. ____

DATE. START: 1-25-99
DATE. FINISH: 1-26-99

GROUND ELEVATION 175.44
GROUND WATER ELEVATION 166.62 2/1/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6" ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0											
40											FROM 45' TO 48', A SUBVERTICAL FOLIATION JOINT, SMOOTH, FRIABLE, SOFT, MUSCOVITE. IN GENERAL GOOD ROCK, MODERATELY JOINTED. (1-65)
50											
10		R6	40'-50'	100 % REC 88% RQD						50'	
											END OF HOLE 50'
60											
20											
70											
30											
80											
40											

Soil Engineer: ____ Driller: GUS SURI

Drilling Inspector: ____ Helper: STEVEN LUEDDEKE

JOB LOCATION:

MOSHOLU GOLF COURSE
VAN CORTLANDT PARK
CONTRACT HED-543

L.99018

WGI Warren George Inc.
SUBSURFACE EXPLORATION

FOR: METCALF&EDDY-HAZEN AND SAWYER

SHEET 1 OF 1
LOCATION BRONX, NY
HOLE NO MG-B47-99
LINE & STA N:323,321.30
OFFSET E:625,396.15

DEPTH ____ FT ____ FT CASING OUT DATE ____
DEPTH ____ FT ALL CASING OUT DATE ____

DATE START: 1-25-99
DATE FINISH: 1-26-99

GROUND ELEVATION 172.97
GROUND WATER ELEVATION 163.05 2/1/99

CASING O.D. HW I.D. ____
SAMPLER O.D. 2" I.D. ____
DIAMOND BIT SIZE NQ

WEIGHT OF HAMMER 300-140 LBS.
INSIDE LENGTH OF SAMPLER 24 IN.

HAMMER FALL
CASING 24" SAMPLER 30"

	CASING BLOWS PER FOOT	SAMPLE NUMBER	SAMPLE DEPTHS ELEV / FEET	SAMPLE RECOVERY	BLOWS PER 6 ON SAMPLER 0-6	6-12	12-18	18-24	DENSITY OR CONSIST. MOISTURE	PROFILE CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL
0		SS1	0'-2'	18"	4	5	6	6		0'-2'	TOPSOIL (3"). DARK GRAY SILTY SAND, TRACE GRAVEL, ORGANIC MATTER. (SM) (11-65)
		SS2	2'-4'	18"	10	10	6	7			
		SS3	4'-6'	12"	18	32	56	100			RUSTY BROWN SILTY F-M SAND, SOME GRAVEL, COBBLES AND BOULDERS. MEDIUM DENSE TO VERY DENSE. (SP-SM AND GP-GM) (6-65)
		SS4	6'-6.5'	5"	100	/5"		/2"			
10										13'	ROLLER BIT FROM 6.5' TO 8', FROM 13.5' TO 15'
		R1	8'-13'	14%	REC						
		SS5	13'-13.5'	3"	100	/3"					
										15'	YELLOW BROWN SILTY F-M SAND, MICA, ROCK FRAGMENTS, COBBLES. VERY DENSE. POSSIBLE SAPROLITIC SOIL (DECOMPOSED ROCK). (SM AND GM) (6-65/5-65)
20		R2	15'-20'	95%	REC						
				78%	RQD					20'	GNEISS. LIGHT GRAY, QUARTZ BAND FROM 17.5' TO 18.5'. WEATHERED, FRACTURED, OXIDIZED, SOFT AND FRIABLE FROM 15' TO 17'. (3-65) MODERATELY JOINTED FROM 17' TO 20', STEEP FOLIATION. (1-65)
30											
40											END OF HOLE 20'

Soil Engineer: ____ Driller: REYNOLDS BRIDGPAL

Drilling Inspector: ____ Helper: ALVRO LONDON

THIS PAGE INTENTIONALLY LEFT BLANK

FMS ID: **CRO-AGS**

THE CITY OF NEW YORK
DEPARTMENT OF DESIGN AND CONSTRUCTION
DIVISION OF PUBLIC BUILDINGS
30-30 THOMSON AVENUE LONG ISLAND CITY, NEW YORK 11101-3045
TELEPHONE (718) 391-1000 WEBSITE www.nyc.gov/buildnyc

Department of Design and Construction

Contract for Furnishing all Labor and Material Necessary and Required for:

CONTRACT NO. 1 **GENERAL CONSTRUCTION WORK**

Croton New Above Ground Structure and Landscaping Rebid

LOCATION: **3651 Jerome Avenue**
BOROUGH: **Bronx, NY 10467**
CITY OF NEW YORK

_____
Contractor

Dated _____, 20_____

Entered in the Comptroller's Office

_____
First Assistant Bookkeeper

Dated _____, 20_____